Railway Age Gazette

Including the Railroad Gazette and The Railway Age

PUBLISHED EVERY FRIDAY, AND DAILY EIGHT TIMES IN JUNE, BY THE RAILROAD GAZETTE (INC.), 83 FULTON ST., NEW YORK.

CHICAGO: Plymouth Bldg. CLEVELAND: Williamson Bldg.
LONDON: Queen Anne's Chambers, Westminster.

W. H. BOARDMAN, *President.*
E. A. SIMMONS, *Vice-Pres. & Treas.* HENRY LEE, *Secretary.*
The address of the company is the address of the officers.

EDITORS:

W. H. BOARDMAN, *Editor.*
SAMUEL O. DUNN, *Western Edit. Mgr.*
BRADFORD BOARDMAN, *Eastern Edit. Mgr.*
ROY V. WRIGHT
G. L. FOWLER
WILLIAM FORSYTH
S. W. DUNNING
CLARENCE DEMING
B. B. ADAMS
W. E. HOOPER
F. W. KRAEGER
H. H. SIMMONS

Subscriptions, including 52 regular weekly issues and special daily editions published from time to time in New York, or in places other than New York, payable in advance and postage free:

United States and Mexico	$5.00
Canada	6.00
Foreign Edition (London)	£1 12s. ($8.00)
Single Copies	15 cents each

Shop Edition and the eight M. M. and M. C. B. Convention Daily issues, United States and Mexico, $1,50; Canada, $2.00; Foreign, $3,00.

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

VOLUME 50. FRIDAY, JANUARY 6, 1911. NUMBER 1.

CONTENTS

EDITORIAL:
Editorial Notes 1
Age Limits 2
The Waste in Through Passenger Service 2
The Increase of Railway Taxes 3

ILLUSTRATED:
The Supply Department 5
LETTERS TO THE EDITOR 4

MISCELLANEOUS:
Annual Report of the Interstate Commerce Commission 7
Prosperity of Canadian Railways 8
Studies in Railway Economics 10
A Letter to Station Agents 11
Waterways; Their Possibilities and Limitations 12
Foreign Railway Notes 7, 11, 12

SHOP SECTION.

EDITORIAL:
Editorial Notes 17
Scientific Management 18
Mechanical Articles During December 19
New Books 19
LETTERS TO THE EDITOR: 20

ILLUSTRATED:
Car Repair Kinks 21
Making Pilot Ribs 28
The Havelock, Neb., Shops of the Burlington 33
Four-Cylinder Balanced Simple Locomotive for the Chicago, Rock Island & Pacific 41
Selection and Use of Machine Tools 46
Care and Selection of Machine Tools and Shop Equipment 48

MISCELLANEOUS:
Continuation School of Cincinnati 27
A New Theory of Belt Driving 27
The Mistakes of the Efficiency Men 29
How the Output of One Locomotive Repair Shop Was Increased 30
Improved Organization and the Effect on Output 30
Lost Motion 31
Increasing the Output of a Smith Shop 32
Cleaning Passenger Equipment at Terminals 40
The Care and Selection of Machine Tools and Shop Equipment 46, 47
Care of Tools and Machinery 48
Selection and Maintenance of Machine and Hand Tools 49
Education of Apprentices on the Santa Fe 51
Foreign Railway Notes 29, 40, 41, 45, 50, 52

GENERAL NEWS SECTION 53
SUPPLY TRADE SECTION 64

IN the supply department, maintaining an economical quantity of stores, there is possibly more room than anywhere else for saving money. H. C. Pearce, general storekeeper of the Southern Pacific Company, has made a systematic study, the results of his wide experience during many years, and we are to have the benefit of that study. The publication of it begins with this issue, and enough of the paper will appear serially to enable the readers, or rather the practical students of this overwhelmingly important subject, to begin independent and properly guided investigations of the losses due to lack of complete organization and intelligent watchfulness. Mr. Pearce indicates, although he does not preach from that text, that somewhat radical reorganization in the supply departments of many roads will be productive of economies. The purchasing agent has either a misleading title and authority, or else is a misplaced officer. The details of purchasing are nearly the least important of his functions. When Sir William Van Horne went to the Canadian Pacific his first great anxiety was for a real storekeeper. He searched the world and discovered—Sir Thomas Shaughnessy!

W. M. ACWORTH begins in this issue a series of "Studies in Railway Economics"— a somewhat oppressive title for his simple and convincing statements of the principles governing railway rate making. His book on this subject, "The Elements of Railway Economics," published five years ago, has had probably a wider and more careful reading by practical railway men than any other similar publication. It has already done a world of good, as its well told basic principles have slowly percolated to the general public. The present series begins with a summary of the unquestionable bases of rate making, easily readable, and we should all read it again—lest we forget. There is reason to expect that the articles in this series will help materially in developing the art of making rates of the least possible burden, combined with qualities of certainty in service, designed primarily to increase commerce. With full publicity and a better knowledge of the facts which Mr. Acworth is making clear, we may safely rely on intelligent regulation to prevent unreasonable rates. Mr. Acworth has a record which entitles him to close attention. He has so far in his numerous studies and writings been unrefuted, not criticizable for expressions of fact or opinions, and this although his statements are cleanly and clearly made. He is at present in this country and doubtless will be glad to receive criticisms or comments.

THE extent to which the traffic and business of St. Louis is being "destroyed" by the so-called bridge arbitraries at that city is indicated by figures which have been compiled by the Merchants' Exchange. They show that the total traffic handled by the St. Louis lines in 1910 was by far the largest in the city's history. A statement which was issued by the Merchants' Exchange says:

"Taking eleven months as a basis and approximating the month of December on an equal basis, the total tonnage of 1910 will amount to about 51,961,190 tons, or several millions of tons in excess of any former year, fully demonstrating that the St. Louis mercantile and manufacturing concerns have kept well to the fore in the progress of the times and have continued to hold its pre-eminent position as a trade center in the supplying of the great and growing territory tributary to this market. Approximating the total inbound and outbound tonnage for the year at 51,961,190 tons, when compared with 44,527,940 in 1909, it shows an increase over the former year of 7,433,250 tons, or 16.6 per cent. Of the amount incoming, both local and that passing through the St. Louis gateway, the total is estimated at 31,565,690 tons as against 27,326,838 a year ago, an increase of 4,238,852, or 15.5 per cent., while the shipments are placed at 20,395,500 tons, against 17,201,102 a year ago, a gain of 3,194,398, or 18.1 per cent. When compared with 1907, the former record period, the total tonnage movement this year shows an approximate gain of 4,140,605 tons, or 8.6 per cent., being 51,961,190 and 47,820,585 tons, respectively. Of the amount the inbound movement for 1907 was 29,445,669 tons, while contrasted with 31,565,690 this year, shows a gain of 2,120,021, or 7.1 per cent., while the outgoing figures were 20,395,500 tons in 1910 and 18,374,916 in 1907, an increase of 2,020,584, or 10.9 per cent."

In view of the fact that it is contended by certain shippers, newspapers and members of the Municipal Assembly of St. Louis that the bridge arbitraries are oppressing terribly the manufacturing and commercial interests of that city, one wonders how fast the growth would be if the arbitraries were abolished!

AGE LIMITS.

A COURT in Indiana has before it a case in which it is called upon by the State Railway Commission to compel a superintendent of the Cleveland, Cincinnati, Chicago & St. Louis to tell the ages of certain telegraph operators who figured in a collision and who presumably are believed to be partly or wholly responsible for it. The superintendent, no doubt, in his refusal, follows the "advice of counsel" and the supposition is that the company is ashamed to let it be known how young these operators are. The age limit, minimum or maximum, is a wholly arbitrary rule for safe-guarding railway trains, whether we consider enginemen, trainmen or telegraphers. The railway which compels conductors to retire on pension at 65 or 70 years probably thereby reduces the income of a few men who would do their duties properly a year or two longer and possibly more; and a road that refuses a boy of 18 a place as telegrapher may deprive itself of a smart and careful operator; but there must be a limit and the only workable limit is an arbitrary one. To make it variable would bring on all sorts of difficulties in administration. Employers, whether principals like a manufacturer or agents like a railway superintendent, very generally lack grit to undertake the unpleasant task of retiring a man of 60 if the man himself is unwilling to be retired; and in such cases there would be little help in a rule authorizing superintendents to exercise discretion. At least no one has dared to try it on a large scale. And a superintendent who should be authorized to take on boys of 18, in some cases (cases of bright boys) would often have difficulty in refusing employment to less promising lads. Twenty-one therefore is probably as reasonable a limit as can be agreed on. This, however, does not necessarily keep bright young fellows away from the service. A superintendent with many employees under 21 years of age could have the satisfaction of knowing that he could take the opportunity of training young men during their apprenticeship more thoroughly, and thus make sure that he would have higher qualifications when the young men should reach the age of 21.

The more rigid enforcement of a limit, both in taking on the young and forcing out the old, would be a blessing in disguise. And not much disguised, either, if fully availed of. If a superintendent were compelled to take boys at 18 or lose them, and at the same time to wait three years before entrusting them with responsibilities, he could at once make his training school a real force instead of the loose and indefinite thing that it often is. Every station or signal cabin employing an agent (or man in charge) who is worth as much as $75 a month ought to be an actual or potential training school. An agent who is not a good teacher should be marked as less valuable than a teacher. All the agents should be kept as nearly uniform in their standards as possible, consistent with a high standard. A traveling teacher, to keep up the standards if a big enough man, with suitable authority, would be a most profitable investment. If the telegraphers' brotherhood should pursue the foolish course of objection to a process like this, designed as it is to improve efficiency, it would be high time for some road to make a determined fight for its full rights, in a policy so clearly beneficial to the public. An interesting thing about the age limit at the other end of the scale is the appearance of signs here and there that an earlier retiring age would be acceptable to some of the men. The pension systems now in force in this country certainly have proved beneficial thus far, and the idea seems destined to spread. When the pension is wholly a gift from the employer, however, it is obvious that the making of the years-limit younger will be more difficult than if the employees themselves contribute. Participation by employees in the support of a fund seems, therefore, a thing to be encouraged. We have wandered slightly from our point—the necessity of a *rigid* limit against excessive youth. This and the limit against old age are two separate questions, but the energetic superintendent will do well to agitate either or both, separately or together; for the main desideratum is to have what in civic and political matters is called an active public sentiment. As to just what the youth limit should be—whether 21, 22, or 20, it would be a good thing if roads having a satisfactory standard should have the merit of their system advertised a bit. The youth limit is no mere academic question. Sometimes 21 seems to be too young. A number of items in the last government accident bulletin, which was reprinted in the *Railway Age Gazette* of November 11, afford suggestive illustrations. For example, collision No. 14 was due to misconduct or negligence on the part of a telegraph operator 23 years old, who had been in the service three months; another operator 22 years old who had seen only two months' service; and a train despatcher 27 years old who had sat in the despatcher's chair only four weeks, though he had been a telegrapher for over five years.

THE WASTE IN THROUGH PASSENGER SERVICE.

SOME of the Western lines recently have made substantial reductions in their passenger service. These have not been merely the usual winter curtailments, but have been made uncommonly heavy for the purpose of to some extent offsetting the large increases in operating expenses that have been experienced since the middle of the calendar year 1910. Probably there is no other part of the railway business in which there is so much room for effecting economies in service without impairing its efficiency as in through passenger business. If Mr. Brandeis had directed his attention to this phase of railway operation he might have suggested some changes which would have been both more practical and more beneficial both to the railways and the public than those he did suggest.

If you will study the schedules of through trains between any two large cities in this country the waste involved in the passenger traffic will at once become apparent. Take, for instance, the passenger train service between Chicago and St. Paul. A number of roads are active competitors for the traffic between Chicago and the Twin Cities. The principal competitors are the Chicago & North Western, the Chicago, Milwaukee & St. Paul and the Chicago, Burlington & Quincy. On these three lines three trains leave Chicago daily between 10 p. m. and 10:16 p. m. which reach St. Paul between 9 a. m. and 10:45 a. m. Three other trains leave Chicago between 6:30 p. m. and 6:35 p. m. and reach St. Paul between 6:55 a. m. and 7:20 a. m. Three more trains leave Chicago at 9:30 a. m. and arrive at St. Paul between 9 and 10 p. m. Although there are nine of these fast trains, there are practically only three times during the day that a traveler can leave Chicago for St. Paul on a fast train on one of these lines, and only three times a day that he can arrive in the latter city from Chicago.

Reading the schedule the other way, three trains on these roads leave St. Paul for Chicago between 8:40 a. m. and 9 a. m., and all arrive in Chicago at 9 p. m. Two other trains leave St. Paul at 7 p. m. and 7:20 p. m. and reach Chicago at 7 a. m. and 7:05 a. m. Three more leave St. Paul between 8:30 p. m. and 8:45 p. m., and reach Chicago between 8:45 and 10 a. m. Three more leave St Paul at 10:30 p. m. and arrive at Chicago between 10 and 11 a. m. So, although there are 11 of these trains, there are practically only four times a day that a passenger can leave St. Paul for Chicago on them, and practically only four times a day that he can arrive on them in Chicago.

The passenger business between Chicago and the Twin Cities is very heavy. The service is splendid. But everyone who has traveled often between Chicago and St. Paul knows that only in certain parts of the year are most of these trains ever crowded to anything like their capacity. In fact, we think it is seldom that most of them have all the lower berths in the sleeping cars occupied, and it is seldom, indeed, that many of the upper berths are taken. These facts regarding the passenger service between Chicago and the Twin Cities might be duplicated with facts regarding the service between Chicago and St. Louis, between Chicago and Kansas City, between Chicago and Omaha; in fact, between any two large centers of population in the country where there is active railway competition.

Suppose that one-half, or even one-third, of these trains were taken off and the schedules of the remainder were so rearranged that they would leave the terminals at more different times. The reduction in expense that would result is obvious, and is it not equally obvious that the service to the public would be improved? Undoubtedly, there are cer-

tain hours of the day when it is more convenient for travelers to depart from and arrive at a city than at other hours; but it is not true that all travelers want to depart and arrive at the same hour. Under the arrangement suggested it would be possible for travelers to depart and arrive at the same hours they do now, though they would not be able to choose between so many trains; but a traveler cannot ride on more than one train at one time, anyway. In addition, those who do not want to leave and arrive at the same hours that the majority do would be able to leave and depart at other times which would be more convenient for them. If the railways would take the money that they thus saved on through service and devote it to providing additional local service, either by means of steam trains or motor cars, both their through and their local traffic would be better served. The additional expenditure on local service would tend to forestall the construction and competition of electric lines; and the experience of electric railways shows that additional local traffic might be built up which would be profitable. It may be said that an arrangement under which the through trains on different roads had different hours of arrival at and departure from terminals would reduce the stimulus to the different managements to try to attract passengers by providing the best possible equipment, avoiding over-crowding, etc. But it would seem that each road would be prompted to continue to provide good service in order to tempt passengers to leave terminals on its trains even though they did not depart at the exact time when the traveler most preferred to leave.

There are two great obstacles in the way of the adoption of any such plan. One is the competition between the railways themselves. We hear a great deal from academic students of railway matters to the effect that competition between railways no longer exists. When they make such statements they have in mind merely competition in rates. Even competition in rates has merely been reduced, not eliminated. The fact that it has been greatly reduced has rendered more intense another and equally important form of competition—that in service. When railways have the same rates between two points the only means they have for attracting business from each other is to give superior service. The only possible way by which a reasonable reduction and rearrangement of through passenger service could be secured would be by some form of concerted action between the railways under which the relative advantages which each enjoys under competitive conditions would be preserved. In England the railways have entered into pooling arrangements under which, while the number of trains run has been reduced, the quality of the service given to the public has been improved in the way that is here suggested, and only by the adoption of some such means could similar results be obtained in the United States.

It is doubtful whether under the anti-pooling section of the Interstate Commerce act and the Sherman anti-trust act the railways could now legally make any agreement to reduce their passenger service even though it involved a rearrangement of time-cards so as to give better service. Even if the law would permit it, it is probable that any attempt to do this would be met with denunciation from the press and hostile demonstrations of public sentiment. As has often been remarked in these columns, one of the main reasons why the railways do not give the best practicable service to the public is that the public will not let them.

But certainly some consideration ought to be given to the matter of the economic waste in passenger service. Passenger earnings per train mile increased only from 97 cents in the unprosperous year 1898 to $1.27 in the very prosperous year, from a passenger standpoint, 1908, or but 30 per cent. Freight revenue per train mile increased meantime from $1.73 to $2.65, or 53 per cent. There must have been, meantime, owing to improvements in service, a larger proportionate increase in passenger train expenses per mile than in freight train expenses per mile. The average number of passengers per train mile for the entire country is still absurdly low, being only 54. In other words, the average train does not haul an ordinary coach load. Where it is so obviously practicable for the railways to save money in a way that will benefit both them and the public it would seem there ought to be some way for them and the public to co-operate to bring about these desirable results.

THE INCREASE OF RAILWAY TAXES.

IT was during a period that may be roughly stated as about two years preceding the fiscal year ended June 30, 1909, that there was a good deal of legislation in various states and in various forms increasing the taxation of railways. New tax laws in general, including those relating to railways, require from a year to 18 months to show results. There is, first, a certain period before the operation of the law; another period before the assessment of the taxes; and another lapse of time, more or less, before they are paid and become public, though this is modified by the allotment of the proportion of taxes for each month in the monthly reports. We are now beginning to see in their fullness some of the returns either from this antecedent legislation dating back two or three years or from other forms of increase. Thus in 1909 the New Haven company paid in taxes $3,446,125, a sum almost certain to be decidedly increased this year. It was nearly 6½ per cent. of gross earnings, more than 42 per cent. of net earnings and $1,723 per mile operated. But even these figures—representing about seven-sixteenths of the New Haven's annual dividend of 8 per cent.—shrink by comparison with railway taxation in New Jersey, where the Delaware, Lackawanna & Western taxes have increased 230 per cent. in 20 years and from 5.4 per cent. on gross earnings to 9.2 per cent.; and where the six leading railways paid in 1909 more than $2,195 per mile and one paid $4,300 a mile.

The cases cited are extreme ones and apply to railway lines with high traffic density, both absolutely and in ratio to mileage. But in its application to the whole country the general truth remains that there is a steady tendency upward in railway taxation. The returns of Poor's Manual show that for 1909, as compared with 1908, railway taxes increased from $82,377,619 to $90,790,949, or about 10.2 per cent., as compared with 2.8 per cent. in mileage, 4.4 per cent. in gross earnings, 5 per cent. in capital stock and 3.7 per cent. in funded debt. Unfortunately, too, this comes at a time when it adds its load to the other financial burdens that the railways are carrying in the shape of increased wages and high cost of supplies. It would be a considerable increment were those two factors constant. Added to them the new taxation doubles its seriousness.

But, besides its expansion, American taxation of railways has its elementary flaws. It has been said with truth that in our many state commonwealths about every form of taxation has been in force that the wit of man could devise. There is state taxation, local taxation and, in some states, mixed systems. In some states the tax goes to the state treasury, in others to the municipalities. Sometimes the state acts merely as a collector who distributes the tax receipts locally. There is taxation of gross earnings and taxation of capital, including debt, sometimes on a basis of par value, sometimes on a basis of market values. But, perhaps, the most inequitable phase of all is the double taxation from which the railway investor suffers. He buys, for example, a bond issued by a railway company in another state which has taxed the corporation fully on all its forms of capitalization—stock and debt; yet he must pay his local or state tax, or both, on his holding. And the railway corporation, in consequence, incurs a double burden—first the direct taxation, and, secondarily, the higher interest return demanded by the extra-state invetsor before he will buy the bond.

The situation calls for two remedies. First, the harmonizing of tax systems and methods in the various states. This, obviously, need not and would not affect the *rate*. The state carrying a heavy state debt and high expenditures may adopt a different rate from the state with little or no debt and low expenses. But in justice to the railways, to say nothing of avoidance of complexities, a state's system of assessment and collection should harmonize with that of sister states; and included in the plan should be such a harmony of tax legislation as

would take into consideration the railway bondholder and exclude double taxation. The second remedy is the modification of arbitrary and absolute assessment of the railways in the direction of taxing actual values. The non-dividend paying line should not be classed in the same taxation group as the dividend payer. This does not mean that the "poor" railway line should be exempt as to its realty, plant, stock and bonds, but merely that its market values should be recognized. This applies to the railway the taxation rule for private property. Some states already have adopted that rule, exercised usually through tax commissioners. It should be the rule in all.

In this matter of taxation the railway corporation, like other public corporations from which returns are exacted, suffers serious disadvantage. It cannot, like the individual or the private corporation, mask in any considerable degree its financial condition. It runs against that common but inequitable impulse of legislative human nature which favors the impersonal rather than the personal tax and forgets that, in the end, they come together. And it confronts constantly that strange legislative and popular fallacy that the chartered privilege, no matter what may be its public benefit, calls for a repayment. In point of fact, the reverse is true and, other things being equal, the public service corporation far exceeds the private enterprise as a promoter of the public weal. New communities almost universally—sometimes old and great states like Canada—express from taxation of railway enterprises. It is a paradox of railway history that the public and legislative sentiment that erstwhile treated the railway as a foster child should now so far rebound to the other extreme, with undue taxation as one of its exponents. That the railway corporations have too often been to blame does not palliate the policy of levying on them all imposts alike unscinetific and unjust.

Letters to the Editor.

THE ILLINOIS MANUFACTURERS' ASSOCIATION.

Chicago, December 27, 1910.

To the Editor of the Railway Age Gazette:

I have read with much interest and hearty approval the able editorial in your issue of December 23, entitled "More Misrepresentation from the Illinois Manufacturers' Association." The article, while severe, is nevertheless amply justified by the facts, and I feel impelled by my natural interest in this vital question to so express myself.

Shortly after the attitude of the Illinois Manufacturers' Association toward the all-important freight rate question was declared, we felt strongly inclined to resign our membership in conjunction with other manufacturers who held similar views. It was thought, however, that we might accomplish more good by remaining within its ranks than by withdrawing, and thus encourage those gentlemen in its board of directors who were honestly, consistently and vigorously advocating a policy of fair play towards the railways, and who were capable of appreciating the equities of the situation.

When recently I found that in the approaching election, those gentlemen who were known to favor such a policy were relegated to retirement from the board, we declined to continue our membership.

E. B. LEIGH,
President Chicago Railway Equipment Company.

TREAT THE CAUSE, INSTEAD OF SYMPTOMS.

Dallas, Texas, November 17, 1910.

To the Editor of the Railway Age Gazette:

The communication entitled, "A Friendly Discussion of Poor Passenger Service," and your comment on it (November 11) constitute a sort of criticism, which, if kept up, should result in benefit both to the railways and their patrons. The subject is one which this writer has frequently discussed through the press during the last ten years. Formerly in the railway service, but long since out of it without a grouch, having been upon "both sides of the counter," he entertains the hope that he may be able to contribute something of value. The views entertained, and here expressed in outline, are based upon experience in the railway service, subsequent observation as a traveling newspaper correspondent, and information gained from railway officers.

Long observation in stations, on trains, around court houses, state capitals, at political conventions, picnics, etc., has convinced this writer that drastic anti-railway measures receive support, not so much because the people care for them per se, as because individuals, having been the victims of poor service, are animated by a spirit of revenge.

At a certain railway station a train was bulletined to arrive and depart on time. It came in eleven hours late, after the bulletin had been raised twenty-two times, on the instalment plan. During the long wait, the writer heard more talk favorable to reduction of passenger rates than he has ever heard at any political gathering. Other converts to the 2-cents a mile propaganda are nightly made upon a railway which does not permit its train auditors to take up and pass along the tickets of through passengers, but, instead, requires each succeeding auditor to wait upon the passengers in person no matter how often it may become necessary to interrupt their sleep. Last summer still more converts were made at a state labor convention, when delegates, about to depart, were curtly refused stop-over privileges at an intermediate point although tendering full fare to such place. One of the offended persons was a high state officer. It was said that no exceptions could be made. True, they could not then be made; but why make fool rules in the first instance? In this case, a few of the delegates, having urgent business at the intermediate point, stopped over, paying full fare in and out; but the company lost the extra fares of a larger number of delegates who wanted to stop for less urgent reasons, and it sent all of these home envenomed against railway corporations.

The *Railway Age Gazette* is correct in its suggestion that it is impossible for railway managers to control their employees as the employees of a store are controlled, for the reason that the former are scattered over thousands of miles, whereas the latter are within a single building and under the manager's eye. True; but too much time, money and thought are devoted to fighting for business at competitive points as compared with "looking after fences" at way stations where the railways enjoy a monopoly.

The comparison with a department store is not apt; but, how about the concerns which employ traveling salesmen, fruit tree agents, book agents, etc., who scatter over the entire country—are not their patrons treated like "the customers of a store"?

Truth is, there is a great deal of incivility and pigheadedness on both sides of the counter. Two vital differences, not generally recognized, distinguish the mercantile business from the railway business. Railway employees often forget that although patrons may be expert shoppers, they are not expert travelers. On the other hand, not many patrons of the railways take into account that ticket agents and trainmen are forced to transact business hurriedly. The customers of a store come in a steady stream throughout the day; those of a railway in bunches from one to 15 minutes before train time, but they expect to buy a ticket a yard long in less time than they can purchase a yard of ribbon.

Railway men from top to bottom need to learn that "A soft answer turneth away wrath." It would help some, too, if railway patrons were to learn the same proverb. However, it gives the writer pleasure to say that many on both sides of the counter have learned it, and that, upon the whole there has been improvement along this line—that the railway service has improved since he left it, as a railway friend declares. There are men in the railway service, in various stations, who are diplomats, and they are invaluable both to the railways and to the public.

Fighting drastic anti-railway measures is but treatment of symptoms; to redress the so-called minor grievances of the public would very likely remove the cause.

TOM FINTY, JR.

THE SUPPLY DEPARTMENT.*

BY H. C. PEARCE,
General Storekeeper, Southern Pacific Company.

I.

The supply department, or what is commonly known as the stores department, of our railways, is an innovation of the last 10 years. Prior to that time, with the exception of the Middle West and the Northwest, the materials and supplies on our large railway systems were mostly specified, cared for and accounted for by the users. The railways had purchasing agents, but they were little more than clerks, under the direction of the general managers, and bought practically what was specified by the several departments. They were traders rather than systematic buyers. In all matters of moment they simply placed the orders as directed by the heads of the departments. The maintenance of the necessary stock, distribution and accounting, was done by the mechanical, or other department using the material. Little or no attention was paid either to what was bought, how it was maintained, or where it was used. In some instances the accounting department maintained a supervision over this work, but it was merely from an accounting viewpoint.

ORIGIN.

The growing roads in the Middle West and the Northwest recognized the necessity for a supply department, owing primarily to long distances from the market, the growing and varied character of their roads, but more particularly from a progressive and economical standpoint. This department was established and maintained on some of these roads as long ago as 25 years; notably the Chicago & North Western; the Chicago, Milwaukee & St. Paul; the Union Pacific; the Burlington, and the Great Northern. The last 10 years have brought great consolidation, new methods and economies, particularly as to the system of buying from manufacturers on specifications. This necessitated a more thorough and complete supply organization, and today, with one exception, there is not a system of any importance that has not a supply department, the business of which is to provide, distribute and account for all materials.

The importance and extent of this work can best be understood by the following figures:

Material and supplies used in the operation and maintenance of 29 principal railways, representing a little over 50% of the total mileage of the United States, as reported to the Interstate Commerce Commission as expended during the year ending June 30th, 1908, was.....$408,636,376
This is made up of approximately 40,000 items, and represents a permanent investment of..... 131,331,587

From this will be seen the necessity of a thorough organization under an officer equipped by experience and judgment, who should report to and be supported by the chief executive officer. That there should be no divided responsibility as between the buyer and the officer who is responsible for maintaining and supplying what is required must be of first importance.

PURPOSE.

The real purpose of such a department is substantially as follows:

First: To provide material that is needed at the lowest cost and with the *lowest possible permanent investment.*

Second: As large consumers to take full advantage of the markets and freights, buying so far as possible direct from the manufacturers.

Third: Proper inspection and test to see that the railway gets what it pays for.

Fourth: To maintain standards by seeing to it that only materials covered by the specifications are ordered and supplied.

Fifth: To properly, promptly and economically care for, handle and account for all materials.

Sixth: Husband resources by keeping materials in as few places as possible, and in such shape that they may be ready to use or move whenever required.

*Copyrighted by The Railroad Gazette.

GENERAL PLAN OF ORGANIZATION.

Organization and system are the foundation upon which depends the success of any undertaking, and in laying out any general plan it must be broad enough and flexible enough to meet all conditions, and always along practical lines. After a thorough, practical working organization is established, the rest is merely a matter of detail and the meeting of conditions. The accompanying chart, which I here submit, will serve to graphically outline the organization. It can be increased or decreased to meet the size and conditions of the property.

The basis is a storekeeper, located at any point where sufficient unapplied material is maintained to occupy the entire time of one or more men to do the work. At points where there is not sufficient material maintained to employ the time of one man handling and accounting, this work can be done by any other department maintaining an organization, but so far as the handling and accounting of the material is concerned, they are responsible for and report to the division storekeeper.

On each division, located at its division shops, there should be a division storekeeper, who should have charge of and be responsible for all unapplied materials on the division, reporting directly to a general storekeeper.

On each system or general manager's jurisdiction, there should be a general storekeeper, who should have charge of and be responsible for all unapplied materials under the general manager's jurisdiction. Reporting to him directly should be the division storekeepers, stationery storekeeper and traveling storekeeper, or inspector of stores. He, in turn, should report directly to the officer in charge of materials and supplies, who may have the title of either vice-president in charge of materials and supplies, general manager or supply agent, who in turn should have reporting directly to him the general storekeeper, purchasing agent, engineer of tests, and fuel agent, and who should in turn report to the chief executive officer.

THE OFFICER IN CHARGE OF MATERIAL AND SUPPLIES.

This is purely an executive office, and should be presided over by a thoroughly practical man, who has had detail experience in the buying, distribution, handling and accounting for railway materials, and thoroughly acquainted with the detailed organization. It is essential that he should know personally the conditions which surround each detail of operation of the department, and the atmosphere which prevails at all points, so that he may intelligently and promptly pass on all matters which are brought before him, and with a personal knowledge of the surrounding conditions. He must have a good general knowledge of the detailed workings and purpose of all other departments, should be absolutely honest and fair, and, above all, must have the entire confidence and support of the chief executive officer; without this his very best efforts will fail.

It is not necessary to maintain a large bureau or office; all records and data must necessarily be prepared by sub-heads. The heads of the departments are in position to call for and obtain any information desired at any time. There is absolutely no excuse for the duplication of work. All contracts should be handled by him, and all changes in standards be issued from his office. He should be a member of the committee on standardization, because upon him and his organization will depend, more than any other department, the maintaining of standards.

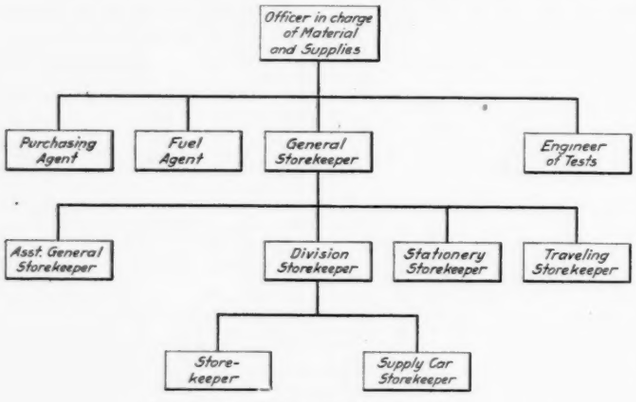
His knowledge of the necessity for promptness in handling requisitions, the placing of orders, tracing and the movement of material to the work, will enable him to force the sub-heads to work toward the end of cutting out every unnecesary move, reduce the permanent investment for material, and, at the same time, give better service.

He should be in constant touch with the other departments, work proposed, financial conditions, matters of policy, and, above all, should be in a position to encourage and direct the work of his sub-heads. He should be in constant touch with the detailed working of his organization, and not allow his office to become

so exclusive that the sub-heads, such as the purchasing agent, general storekeeper, engineer of tests and others, may feel that they are not privileged to consult with him at all times. They should understand that they are not only privileged, but it is their duty to consult and advise with him constantly. This confidence must exist if the organization is to be useful. By eliminating the detail of bureau work from his office, he is in a position to give these matters the necessary personal time, as well as to give ample time to investigation and keep in touch with the various departments, and the general policy of the owners.

THE PURCHASING AGENT.

It is not necessary that the purchasing agent should have a knowledge of the practical application of the material which he buys, in fact, with our large systems it is hardly possible. Many of our best purchasing officers have little or no knowledge of the material they buy. They are fully protected by the specifications, tests and store inspection. He should be a keen, wide-awake business man, absolutely honest and fair, a good seller as well as a good buyer. The selling is as important as the buying, and in many respects more so. He should maintain a thorough and complete office system and records. All requisitions for material should go to him. A system of bids and prices should be maintained; in fact, the unit of efficiency for his office is *prices* and *deliveries*. His organization must be so systematized as to handle the requisitions in the least possible time,



Supply Department Organization.

which means that his data should be so arranged that it can be as promptly applied as the material on the shelves of the storehouses. Every day saved in the handling of requisitions saves complaints and delays, places the material that much closer to the user, and in the same proportion reduces the investment. Material covered by contract or agreement should be so tabulated and arranged that the orders can be placed in every case the day the requisitions are received. There is no excuse for any delay in placing the requisitions for material covered by contracts or agreements, the order being merely a matter of form to check against prices and deliveries. Competition should be encouraged and competitive bids obtained and tabulated.

All scrap, surplus and obsolete material should be sold by him. This will be found a great economy to his company, and requires the exercise of excellent business judgment.

The full power of the purchasing officer should be concentrated on three things:

First: The buying of material at the lowest possible price.

Second: Obtaining the quickest possible deliveries.

Third: Selling scrap, obsolete and surplus material to the best advantage.

THE GENERAL STOREKEEPER.

The general storekeeper should be the active executive of the organization, and must be a thorough organizer, disciplinarian, tireless worker, and have a thorough detailed knowledge of all matters pertaining to the providing, handling, distribution and accounting for materials, as well as a good knowledge of the operations of the various departments, particularly the mechanical and maintenance of way. It should be his duty, not only to provide and care for material, but to know that it is properly applied to the company's requirements. His office should be largely executive, dealing directly with the division storekeepers, where the details of the work and records are kept. He must be in accord with the operating department at all times, and keep informed of the progress of its work. His time will be occupied in maintaining the organization, strengthening the weak places, inspection, providing facilities, anticipating demands, curtailing expenditures, cutting off unnecessary purchases, sorting over and making over second-hand and obsolete materials, arranging for sale of obsolete and unused materials and tools, and in every way maintaining an organization which will *provide for actual requirements*—one which will deliver material that is actually needed to the work in the least possible time. On him devolves, probably more than any other officer, the maintenance of standards. His unit of efficiency is *percentage of actual purchases to disbursements* and *permanent investment for material.*

THE FUEL AGENT.

The segregation of locomotive fuel from the other material under a fuel agent, on roads where the conditions and the volume of business may warrant, is for the purpose of more direct supervision. The fuel agent should have a good knowledge of the location and kind of fuel available. He should strive to establish competition among the different producers. He should arrange to provide the quality of coal which is most economical and suitable for the particular class of equipment and service operating on each division or district. He should so arrange the delivery of fuel as to keep up the necessary supply with the least possible amount of stock fuel on hand, and keep in mind the need of the service.

Fuel inspectors should report to him.

THE ENGINEER OF TESTS.

It is important that the engineer of tests should report to the officer in charge of material and supplies in order that delays may be prevented. His position is to make sure that the company gets exactly what the specifications call for. His organization should be so arranged that material can be inspected promptly so that deliveries will not be delayed. He should investigate and test materials offered for sale whenever so desired by the general supply officer. He should, in conjunction with the mechanical engineer, assist in the preparation of the specifications for material. In this alone, his detail knowledge of the service and the use of materials will make him of great value. The greatest care should be observed in preparing the specifications to see that they are made along practical and economical lines, taking into consideration, of course—first, the service desired; second, the markets and prices, and prepare them in such a way that they will neither be extravagant nor restrict their manufacture.

THE DIVISION STOREKEEPER.

The division storekeeper is to the division what the general storekeeper is to the system, and in addition must maintain the working organization and records. He should have full charge of all unapplied material on the division and all requisitions originating on the division should be sent to him so that they may be filled so far as possible from material on the division. They should then be sent to the general storekeeper when necessary for completion, the general storekeeper filling the requisitions from unapplied material from any part of the system, and if the necessary material is not in stock, ordering the same purchased.

Necessarily the division storekeeper should be located at the principal shops of the division, in order to avail himself of the company's facilities for repairing and making over material. He must have accurate and first knowledge of all work going on, as well as contemplated, and keep in active touch, not only with the

division officers, but with the men actually doing the work. He should have charge of the supply cars operating over his division, sorting of scrap, the application of surplus and obsolete material, and the accounting on his division under the direction of the auditor. He should maintain a general stock of material for the division at his headquarters, moving it from the general store in carloads, and distributing it over his division in supply cars, or by other means whenever it may be necessary to meet emergencies.

THE STATIONERY STOREKEEPER.

The stationery storekeeper should be a man that has a practical knowledge of forms used, different weights of paper and methods of padding; in other respects his organization should be identical with that of the division storekeeper, except that it should handle only stationery, and for the entire system.

THE TRAVELING STOREKEEPER OR INSPECTOR OF STORES.

The traveling storekeeper should be the lieutenant of the general storekeeper, and must be primarily an accountant, for the reason that he will constantly be called upon to take charge of division stores, owing to sickness, absence, or changes, and must be so equipped that he can operate the division from the office. He must be able to go into an office at any and all times and check it up, to see that the work is being handled properly and in accordance with established methods. He should, of course, also have a good practical knowledge of the material and its uses, and be able to direct its proper handling and application. However, as most division stores have practical men of this character in their organizations, it is not only absolutely essential that the traveling storekeeper should be able to operate the store or the division in a general way. It is important he should have a thorough knowledge of the organization as a whole in order to attain his full value as a representative of the general storekeeper on the ground.

ANNUAL REPORT OF THE INTERSTATE COMMERCE COMMISSION.

[The first part of this report was noticed last week, page 1264.]

Accidents.—The report gives the usual brief summary of accidents for the year ending June 30. These figures, as published in the government's quarterly bulletin, have been given in the *Railway Age Gazette,* November 11, page 925. Reference is made to the fact that the accident law has now been changed, so that beginning with the current fiscal year the commission will abandon the inconsistency of presenting two separate reports of accidents each year. The new law authorizes the commission to investigate accidents, but, says the report, "the commission has not yet been able to take action under this act, for the reason that to secure proper and adequate investigation of railway accidents under suitable conditions, and for the purpose aimed at in the passage of the law, it will be necessary to employ permanently a number of men of experience, character, and ability; and there is as yet no appropriation sufficient to provide for such employment and for the necessary traveling and clerical expenses. To investigate train accidents generally throughout the country with a view to locating the blame in particular cases must indeed be considered as practically out of the question, as there are so many accidents occurring on the extensive railway mileage of the United States that the expense of conducting inquiries by competent men would be almost prohibitive. It is not believed, however, that the law contemplates such numerous investigations. Its purpose, as we understand it, is not to examine the details of the collisions and derailments occurring every month, but rather to formulate, for the benefit of Congress and the public, the lessons to be learned from typical accidents. This object can be accomplished at a reasonable cost."

Brief reference is made to the records of the last year, compared with preceding years, and the commission renews its recommendation for the extension of the use of the block system.

Safety Appliances.—The railways are making marked improvements in their practice and are guarding better against violations of the laws. Most of the roads are increasing the number of inspection points and making other changes, but there is still room for further improvement. The commission believes that it was the intention of Congress, in the original safety appliance act, that train men should not have to ride on the tops of cars to work the hand-brakes, yet the practice still prevails, and the deaths and injuries classed as falling from cars and those due to overhead obstructions continue to pile up large records every year. A suit to test the lawfulness of the practice of requiring train men to operate hand-brakes is now pending in the federal court for the Western district of Pennsylvania (U. S. vs. B. & O., 176, Fed. 114). During the last fiscal year the commission reported to the law officers of the government 431 violations of the safety appliance act, and 140 of these were contested by the roads. In 130 of these, verdicts were rendered in favor of the government, and the amount of penalties recovered aggregates $51,400. The commission has published an index-digest of all decisions under the safety appliance acts. The decisions of the courts as to the meaning of the safety appliance acts are now pretty generally in accord, but several important cases are still pending in the Supreme Court of the United States.

Safety Appliance Standards.—Standards for the construction and application of grab-irons, ladders, sill-steps, hand-brakes, running-boards, etc., were prescribed by the commission on October 13, in accordance with the law of April 14 last. These standards, which were settled upon at conferences with the railway officers, have been heretofore set forth in the *Railway Age Gazette.* The commission asks Congress to relieve the carriers from compliance with this law in the case of cars which were under construction at the time the law was passed. The law provided for relief only in case of cars which were actually in use when the law was passed; it should have said when the law went into effect.

Hours of Service Law.—The commission notified 1,314 roads to comply with this law, but only 949 have obeyed the notice. The suit contesting the law, which was instituted by the Baltimore & Ohio, was decided in the circuit court in favor of the government, but it is now pending on appeal in the Supreme Court of the United States. Among the reasons given by railways, in their reports, for requiring employees to be on duty excessive hours, are "leaky valves," "hot boxes," "burst air hose" and other causes of that kind; and the commission calls for an amendment to the law so that the railways shall not have so much latitude in determining what is an "unavoidable accident" warranting disregard of the terms of the law. The practice of some of the roads in this respect has already been corrected or improved by correspondence. During the past year, the commission has received 188 complaints of violation of the law, mostly concerning telegraph operators. Of these complaints 136 have been settled by correspondence or otherwise and 52 are now under investigation. In several cases two telegraph offices are maintained at the same station in close proximity, one being operated during the day and the other during the night. The railways insist that this is not unlawful. The case which was instituted against the Atchison, Topeka & Santa Fe in Illinois, April 21, 1909, to test the lawfulness of the company's arrangement of hours of telegraphers, is now pending in the United States Supreme Court.

Block Signal and Train Control Board.—Brief reference is made to the work of this board, the annual report of which will be issued as a separate document. The twenty-second annual convention of State Railway Commissioners, which was held in Washington, November 15-17, is also noticed, and members of Congress are informed that they will be furnished with copies of the published proceedings of that convention.

The National Congress of Chile has authorized the executive to invest $1,375,000 in the acquisition of the railways owned by the Copiapo Railroad Company.

PROSPERITY OF CANADIAN RAILWAYS.

BY J. L. PAYNE,
Comptroller, Department of Railways and Canals.

The railways of Canada increased their net earnings in 1910 by 32.3 per cent. This may seem like commencing with the climax and working backward; but from that fact radiates a story of strength and prosperity which will not lose in force by an anomalous introduction. The growth of railway interests during the year was merely a reflex of the advancement which took place in all the material circumstances of the Dominion. It was a significant and concrete earnest of things to come; for Canada may be said to have just entered upon her larger heritage in this northland.

The increase in mileage over 1909 was 627 miles of main line, 79 of second track and 393 of yard track and sidings. Of the increase in main line, 519 miles was in the four western provinces. This was natural, for it is in that portion of the dominion that development is chiefly in progress. The new mileage of 1910, however, had no reference to the Grand Trunk Pacific, which is under construction from ocean to ocean, although the company had 1,500 miles of line in actual operation. It is running a regular service between Winnipeg and Edmonton, and before the wheat movement began this autumn it completed its freight connection with Fort William at the head of Lake Superior. Of new trackage of all sorts 3,818 miles have been put in operation within four years.

The whole of the mileage of the Grand Trunk Pacific is still officially regarded as being under construction. Business over the completed sections is being carried on by special permission of the railway commission, in which respect it is in the position of several other lines throughout the dominion. The term "under construction" is exceedingly comprehensive; yet, under the popular definition, at least 4,500 miles were so classified on June 30. It might be said that the Hudson Bay Railway is under construction, since the dominion government has completed surveys and given contracts for two large steel bridges over the Nelson river. That will be a unique line, in that it will be one of the best equipped on the continent, so far as roadbed and rolling stock are concerned, and yet is not likely to be in operation for longer than four months in each year. Its mission will be to carry out from 120,000,000 to 200,000,000 bushels of wheat during the season of navigation through Hudson Straits, and if it succeeds in doing this at a saving of two cents per bushel to western producers it will justify the expenditure of $25,000,000 for construction and equipment by the government.

Capital kept pace with mileage. The increase for the year was $101,816,271, which brought the grand aggregate up to $1,410,297,687. This total comprised $687,557,387 of stocks, and $722,740,300 of bonds. To this might properly be added the $190,753,063 received by railways in cash subsidies, plus the cost of government owned lines—$118,018,751—and if this sum were divided by the mileage it would show a capital cost of $69,510 per mile. That, however, would be a delusive result if the object in view were to ascertain the actual outstanding capital liability per mile of line. The government railways have not issued stock or bonds, and the subsidies were in the nature of gifts pure and simple. Liability is one thing and cost another. Moreover, there is a very considerable volume of capital duplication. The larger lines have absorbed smaller roads in many cases and issued their own obligations to cover the cost of purchase or control. Without going into details, which would necessarily be elaborate to clarify the account, let it be said at once that a carefully prepared statement shows that the real outstanding and live liability of Canadian railways amounted on June 30 last to $52,612 per mile. There can be no suggestion of overcapitalization in such a situation.

Associated closely with the foregoing is the account with respect to aid. It is decidedly complicated. No one can compute in dollars the assistance which the federal and provincial governments, as well as municipalities, have given. The cash is easily followed. It amounts to $190,753,063, of which $1,789,723 was paid to railways in 1910. But what value shall be attached to the 32,040,378 acres of land granted by the dominion government, or the 9,926,993 acres alienated by the provinces of British Columbia, New Brunswick and Nova Scotia? Quebec gave 13,324,950 acres of land; but redeemed nearly all at 52 cents per acre. The Canadian Pacific, on the other hand, which still holds over 12,000,000 acres, sold $975,030 acres during 1910 at an average of $14.84 per acre. Within quite recent years it has been popular to give guarantees of bonds, instead of cash or land subsidies, and obligations of that character were outstanding on June 30 to the extent of $127,336,357. To all this must be added the cost of 1,815 miles of the Grand Trunk Pacific, which is being constructed by the government between Winnipeg and Moncton, and which will not fall below $125,000,000. Here is a very big account, which cannot in the final total reach less than $700,000,000. No other country has done so much for transportation.

The public service of railways in 1910 involved carrying 35,894,575 passengers and 74,482,866 tons of freight. These figures represent an increase of 3,211,267 passengers and 7,640,608 tons of freight over 1909—the largest expansion of any year in the history of Canadian railways. In order to condense what would otherwise be a long story, the following items with respect to traffic are selected:

	1909.	1910.
Passenger density	84,342	99,742
Passengers per mile of line	1,355	1,451
Passenger journey—miles	62	69
Passengers per train	51	59
Freight density—tons	545,991	635,321
Freight haul—miles	197	211
Tons per train	278	311
Cars per train	16.37	18.15
Tons per car	16.98	17.13

These facts in succinct form illuminate the opening observation with respect to net earnings. They show that heavier units are commencing to affect quite materially the trainload and carload. Canada in these respects, however, is still behind the average of the United States. The number of passengers per train is precisely the same as that shown by American statistics; but the average tons per train is 77 less and the number of cars per train 11.6 less. In length of passenger journey and freight haul, however, Canada leads the world. This is due to our peculiar geographical position, which practically makes all traffic move either east or west, and for long distances.

It is perhaps worthy of special reference that 3,075,298 of the increased tonnage for 1910 came within the classification of manufactures merchandise and miscellaneous. They constitute the best paying classes of freight. Products of agriculture made up 17.31 per cent. of the traffic, products of animals 3.71, products of mines 35.11 and products of forests 17.54—a total of 73.67. This left 26.33 for the higher grade commodities, which was 4.34 per cent. above the showing of United States railways for 1909. Canada, however, falls below her neighbor in volume of manufactures.. It may not be amiss to say at this point that the statistical schedules and classifications in force in Canada and the United States are in all respects identical; so that comparisons may be made with accuracy in all the aspects of operation.

Gross earnings aggregated $173,956,217, and showed a gain of $28,899,881 over 1909. The operating expenses amounted to $120,405,440, or $15,805,356 more than for the preceding year. It will be seen that the relative difference between income and outgo suggests the probable practice of rigid economy. This would have been both sane and natural after the rather trying experiences of 1908 and 1909, with wages and the cost of material steadily ascending and revenue shrinking. Yet an analysis of operating expenses reveals a liberal policy in all that related to physical upkeep. For example, maintenance of way and structures showed an advance of 2.23 per cent. over 1909, while

equipment ran 1.03 ahead of that year. These figures would indicate substantial betterments, especially as these divisions combined made up 44.05 of the total. The saving occurred under the head of transportation, which is precisely where it should be found in a sound system. When a railway starts out to economize unwisely, it invariably skimps roadbed and equipment. When it saves prudently, the reductions may always be looked for in the conduct of transportation, which is invariably the chief avenue of waste. To make the operating situation plain the following comparisons may be given:

	1909.	1910.
Way and structures	$21,153,274	$27,035,603
Equipment	21,510,304	26,002,301
Traffic expenses	3,798,825	4,366,177
Transportation	54,284,587	58,928,171
General expenses	3,853,094	4,073,188
Total	$104,600,084	$120,405,440

There was a slight decrease in the average receipts per passenger per mile, and a small increase in the rate per ton mile for freight, the figures in one case being 1.866 cents and in the other .739 cents. The United States rates are about the same. Happily, there is nothing approaching an organized agitation on this side of the line for a two cent passenger fare. It could not be defended, and would seriously cripple, if not destroy, many of the smaller roads which are barely able to make one hand wash the other under present conditions. It would be difficult to prove that any line in Canada makes a clear and considerable profit out of its passenger traffic. The passenger density is too low in a country which has the highest railway mileage per 100 of population in the world.

One or two other features in connection with earnings and operating expenses are worthy of accentuation. For example, there were 24 reporting railways which in 1910 showed a deficit. On the other hand, twelve roads had net earnings amounting to 97 per cent. of the total. This latter fact emphasizes very strikingly the tendency toward centralization of transportation power. In the railway world the larger absorb the smaller, and thus demonstrate an analogy with the natural kingdom. And who shall say this process does not, in the final reckoning, serve in the best way the broad interests of the people for whom railways are built? The year 1910 also gave proof of the rising cost of train operation. Twelve years ago it required 77.9 cents to run a train one mile; now it costs $1.41. Train earnings have also increased; but, while the income from that source has grown by 70.8 per cent. since 1899, the operating cost has advanced by 80.8 per cent.—and in one way and another all the activities of a railway, no matter in what direction, are centered in the running of trains. Earnings per passenger, per ton, per passenger train mile, per freight train mile and per mile of line showed encouraging increases in 1910; while, per contra, the cost of operation per train mile rose from $1,309 to $1,409.

A brave effort is being made year by year to strengthen the motive power and to add to the car supply of Canadian railways. In 1910 the increases were: Locomotives 110, passenger cars 138, freight cars 1,934 and company's cars 789. The total was brought up to 4,079 locomotives and 132,681 cars of all classes. The increase in freight equipment was chiefly in box cars. There was an actual decrease in flat cars. What was perhaps more significant than increase in numbers was the addition to capacity. In 1907 the average capacity of box cars was 27.6 tons; in 1910 it was 29.1 The service performed by each freight car was 622 tons, which was 55 tons better than for the preceding year. Per 1,000 miles of line the equipment of 1910 was as follows: Locomotives 165, freight cars 4,840, and passenger cars 174. This showing is not nearly so good as the situation in the United States discloses; but it is rapidly improving. In Ontario the available supply of cars is probably quite up to the American average; but in the western provinces the requirements of new mileage are not so large.

On June 30 there were on the pay rolls 123,768 employees, in addition to which outside operations required a staff of 16,709. Numbers are ascertained by counting noses on a particular day, and, while a better method has not been devised, it is not by any means satisfactory. A comparison of the aggregate of wages paid during the year is safer. In 1910 the sum paid to employees of all classes was $67,167,793, as against $63,216,662 in 1909, and $58,749,493 in 1907. The growth revealed by these figures is much larger than by placing numbers side by side, and it tells the story of the rising cost of labor. It also throws a strong light on the operating situation. For example, it has already been pointed out that the relative increase in the cost of conducting transportation was not so large in 1910 as were the increases for maintenance of way and equipment; but the wages paid under the head of transportation amounted to $32,091,952 in 1910, as against $24,656,585 in 1909. The saving effected in that division did not, therefore, apply to wages. In this relation it may be instructive to compare numbers of employees and the average rates of pay in the United States and Canada:

	United States.		Canada.	
	Number per 100 miles.	Average daily pay.	Number per 100 miles.	Average daily pay.
General officers	2	$12.67	2	$10.72
Other officers	3	6.40	3	4.73
General office clerks	30	2.31	28	1.94
Station agents	15	2.08	12	2.16
Other station men	58	1.82	51	1.65
Enginemen	24	4.44	18	4.12
Firemen	26	2.67	20	2.53
Conductors	18	3.81	13	3.30
Other trainmen	49	2.56	32	2.12
Machinists	20	2.98	12	4.40
Carpenters	26	2.43	17	2.52
Other shopmen	83	2.13	62	2.19
Section foremen	18	1.96	18	2.18
Other trackmen	136	1.38	122	1.58
Switch tenders, crossing tenders and watchmen	19	1.73	7	1.57
Operators	17	2.30	12	2.20
Floating equipment	4	2.31	1	2.19
All others	90	1.98	71	1.95

Accidents in 1910 may be dismissed with the shortest possible reference as an unavoidably distressing feature of railway operation. From the movement of trains 524 persons, of whom 60 were passengers, were killed, and 1,441 were injured, of whom 270 were passengers. It was rather a bad year for accidents to passenger trains, the second worst in our history. One passenger in every 598,243 was killed, and one in every 132,943 injured. Collisions accounted for the death of 2 passengers and derailments for 44. Of employees 214 were killed and 926 injured. There have been many worse years, so far as employees are concerned. At highway crossings 63 persons were killed and 61 injured. There is a well-sustained movement in progress for the elimination or protection of level crossings, and during the year 1910 the number of subways and overhead bridges increased by 66, while electric bells and watchmen were multiplied materially. Strange to say, there was an actual decrease in the number of gates in use.

Twenty-three years ago Grover Cleveland, in his capacity as president of the United States, created great anxiety on this side of the boundary by a threat of commercial non-intercourse with Canada. At intervals since that period other statesmen have spoken thoughtlessly along the same line. The word "thoughtlessly" is used advisedly, because these influential people had not paused to measure the close identity of commercial interests on the northern half of this continent. They had not, for example, taken cognizance of the railway situation. This alone ought to make for permanent peace and reciprocity. The interwoven character of transportation relations was pronounced in 1887; it creates a positive and permanent unity today. There are at this moment 22 distinct American railway corporations with lines in Canada. These roads represent a capital liability of $110,000,000 and 1,703 miles of track. They did in 1910 a volume of freight business aggregating 15,447,776 tons. On the other hand, Canadian railways own and operate hundreds of miles of line in the United States.

Summing up, very briefly, and at the cost of repetition, it cannot be too clearly understood that Canada has entered upon a period of commercial expansion which must lead to a corresponding development of railway interests. The year 1910 created a

new record in volume of traffic and value of earnings; but the figures in those regards will inevitably swell with the growth of production. It is known that 325,000 settlers came into the Dominion during the year just closed, and in that fact alone lies an inestimable potentiality. The decennial census will be taken in April next, and it is confidently expected to reveal an increase in population of at least 80 per cent. That will signify a nation of nearly 8,000,000. Every man, woman and child is either a producer or a consumer, often both, and every penny's worth produced or consumed means traffic. The Canadian people, although highly prosperous, have but recently acquired that faith in the future of their country which finds expression in noble enterprises. They had grown timid while waiting; but now they have become aggressive. As they push out to the limit of their strength, the tale of their progress and achievements will, among other things, be splendidly told in larger and more surprising railway statistics than were created in 1910.

STUDIES IN RAILWAY ECONOMICS.

BY W. M. ACWORTH.

I.

Five years ago I published a small book on the subject of Railway Economics.[1] I stated in the preface that what I had written was only an instalment of what I had meant to write and added that I should be grateful for any criticisms, and trusted that the complete work when published would benefit by them. Though the book has found a wider audience than I had expected and has been translated into several foreign languages—Magyar and now Japanese among them—the criticisms I had hoped for have unfortunately failed to reach me. It was perhaps expecting too much that readers would take the trouble to communicate with me personally, but the kindness of the Editor of the *Railway Age Gazette* now offers me the hospitality of his widely read columns to put forward my tentative conclusions on various points, and I am, therefore not without hope that competent critics both in England and in America will discuss in the columns of the *Railway Age Gazette* some of the points which I may raise.

Let me briefly summarize the scheme of my published book as far as it went. I began by showing that, though a railway was nothing more than a specialized road, a railway undertaking really comprised three distinct functions: owning the road, owning the vehicles that run on it, and carrying for hire; and I pointed out that in this respect a railway was different from all other undertakings concerned in transport.

Turnpike trusts and canal companies own the road, but do not carry on it; tramway undertakings, which are most nearly analogous to railways, have only a modified ownership and non-exclusive use of their road; while barge owners, road carriers, omnibus and steamship companies, and the like, have no ownership in their road at all. Railway rates, I pointed out, combine two things: interest on capital provided and charges for services rendered, made up—in our own country and dealing with railway rates as a whole—in the proportion of 8 shillings ($2) out of every £1 ($5) interest on capital provided, and 12 shillings ($3) charge for services rendered.

I went on to show that the capital of a railway is enormous in proportion to the business done (it takes an average English company about ten years to turn over its capital once); that this capital is spent once for all and immobilized on the faith of traffic which may or may not come, and which can only be attracted at rates which must be guessed at in advance. I showed further that, while large traffic is necessary to make possible low rates, low rates are necessary to secure large traffic. Then, on the side of railway expenditure, I pointed out that capital is spent for the sake not of any particular traffic, but of the business as a whole; that the same thing applies to the greater part of the current expenditure, almost the whole of permanent way expenditure, a large part of locomotive cost, and perhaps an even larger part of what is called traffic expenses. From this I drew the conclusion that it is impossible to base railway rates on cost of service; for the cost of any particular service is not an objective fact, but a subjective estimate. And I further showed that, if it were, which it is not, possible to base individual rates on cost of service, to do so would be in the interest neither of the railway undertaking, nor of the public which it served. For by doing so the railway would lose a great deal of traffic which can contribute some portion, though not the whole, of the general expenses of the undertaking, and the public would find the traffic in bulky and low priced goods, and even in medium priced goods over long distances, shut out altogether, while such goods as would still be carried, deprived of the help of the goods shut out, would have to bear the whole railway expenses unaided, and so would find their own rates much raised.

Having shown that rates could not and should not be based in practice on cost of service, I went on to assert that in principle they never had been so based either on state railways, or on the railways of private companies, and I said that the belief that the German state railways do so base their rates was entirely erroneous. I asserted that everywhere, on state railways, as much as on private railways, freight rates and (though in a less degree) passenger fares were based on what the traffic could bear. I discussed at length the meaning of this phrase, and pointed out that it was a principle, not as had been supposed of extortion, but of moderation and restriction, and suggested that "tempering the wind to the shorn lamb" was really the right way to describe it. I further pointed out that, so far from being a principle special to railways, it was a principle universally accepted through all the range of business, whether for sale of goods, or for sale of services, and also accepted in public affairs as embodied in the common canon of taxation "equality of sacrifice." It is perhaps worth pointing out that since I wrote, the principle has with very general acceptance been pushed further in the matter of national taxation. Fierce as was the attach on Mr. Lloyd-George's budget of 1909, few people ventured to dispute the justice of the broad principle that old-age pensions, by which poor people only benefit, should be paid for largely by increased income tax, super tax, and enhanced death duties, levied solely from the class who could never directly benefit by these pensions. I may add that I analyzed at some length from another point of view the phrase "what the traffic can bear," and I showed that "can bear" means sometimes "is capable of bearing without being crushed out of existence," and at other times "will consent to bear without going off to a rival route."

The rest of the book sketched in outline the historical development of the existing English rate situation, showing that in the main it has grown up in response to the demands of an extending trade, but that the state has interfered in every increasing measure, and I gave some reasons for thinking that the three most important interventions of the state: the fixing of maximum rates, the law of undue preference, and the restriction on increase rates, had not, on the whole, resulted in the advantage to the public which they were designed to secure. I wish to emphasize the point that throughout the book, wherever I was dealing not with local history but with general principles, I claimed, and believed that I had good reason to claim, that those principles were of universal application. I desire to emphasize this point for two reasons: In the first place, German critics, whose competence and courtesy I fully acknowledge,[2] have ignored my point. They have said in effect, "Mr. Acworth's book is interesting as showing the point of view from which railways are regarded in the native country of private enterprse, but Germans, of course, believe in a state system and so look at the matter

[1] The Elements of Railway Economics. Oxford; at the Clarendon Press. 1905.

[2] Dr. von der Leyen in Archiv für Eisenbahnwesen, and Dr. von Wittek, ex-Austrian Minister of Railways, in the preface to his translation of my book.

with other eyes." My submission is that this is not so. I submit that the economic principles applicable to railways are applicable to all railways alike; that state enterprises do and must build their railways in the same manner as private enterprise, equip them in the same manner, operate them in the same manner, and fix the rates on them in the same manner. The second reason why I desire to emphasize the university of the economic principles underlying railway management is that I wish to make it a starting point in what follows. If there be, as I believe there are, general principles of universal application, we can test the railway policies of different periods and different countries, by showing how far they conform to the underlying principles, and this is what I propose to do in the articles that will follow.

I have said that there is a common but erroneous belief that the German tariff is based on cost of service. There is indeed a historical foundation for this belief. The present German tariff began with a system in which there were only three scales of rates, all on a mileage basis: (1) so much per ton per mile for small consignments (i. e., less than five tons); (2) a lower rate per ton per mile for consignments of five tons (i. e., half car loads); (3) a still lower rate per ton per mile for consignments of ten tons (i. e., full car loads). There were also terminal charges on all three classes.

It is true that this tariff was not really based on cost of service, for any railway man knows that it does not cost ten times as much to convey a truck 100 miles as to convey it 10 miles, but cost of service was intended to be the basis, and, no doubt, was believed to be the basis by the theorists, who have always had considerable influence on German rate making.

The modern German tariff, though it still preserves the fundamental distinction between (1) small consignments, (2) five-ton lots, and (3) ten-ton lots, has departed widely from the original idea. There are two classes for small consignments, there are four classes for five-ton lots, and five classes for ten-ton lots. And the classification in each category is substantially based on the consideration of what the traffic can bear.

Further, the departure from the original idea is clearly made manifest in a peculiarity of the German tariffs: the terminal charge is less for short-distance than for long-distance traffic. Now it will hardly be argued that it costs more to load and unload and marshal a wagon going from Cologne to Düsseldorf than a wagon going from Cologne to Breslau. The only possible excuse for the distinction is that short distance traffic cannot (in this case it is more probable will not) bear the full rate. Then again the ordinary tariffs are still on a pure mileage basis, i. e., the conveyance rate for 5,000 miles is precisely ten times that for 50 miles. But in the case of the lower class of small consignments and the lowest class of ten-ton lots this basis is departed from and the rates are calculated on a sliding scale—*"a base de' croissante,"* to use a more expressive French phrase. There can be no other explanation than that the logic of facts is too strong for theory, and it has been found necessary to temper the wind to the shorn lamb, and let off the lower class traffic more lightly than the traffic of higher value. I may just add that the vast proportion of German traffic—I believe nine-tenths of the whole—goes in ten-ton lots, and, of course, the bulk of this is the lowest class, and, therefore, the difference between the sliding scale rate and a rate based on sheer milage is of the utmost practical importance.

(To be Continued.)

The Ecuadorian Legislature has recently approved a contract between A. Henry Higginson, an American, and Edward Morley, an Englishman, for the construction of a railway line which, starting from Puerto Bolivar and passing through the cities of Cuenca and Azogues, shall eventually terminate at Biblian. The traction will be either steam or electricity, and the gage is to be 3 ft. 6 in.

A LETTER TO STATION AGENTS.

BY A. B. ALLEN.

In a great many cases it seems to be a hard matter for the station agent to realize just what his duty to his employer comprises. I refer particularly to personal disposition, what people vaguely term personality. The local agent is certainly a true medium through which the great public is influenced for or against his particular company and for or against railways as a whole.

Transportation is the principal business of a railway, but as railways develop and push further and further into virgin territory, and the towns grow, these railways become representative of immense wealth in properties, including lands, equipment, terminals, etc. This is a natural outcome, and could not be otherwise. Complications arise, property disputes, and differences of all kinds with the people develop, and as the railway must necessarily defend itself, many cases go to court.

This is one way by which the railways are forced into politics. Their troubles and their politics naturally furnish much meat for flaring and deceiving headlines for sensational newspapers, and the newspapers are, of course, the great contemporary educators of the people. This goes on and on, and thus a large proportion of our citizenship is influenced against railways as a whole.

Accordingly, assuming that our patrons are often in this frame of mind, the minute that a piece of their freight goes astray, or when demurrage or storage accrues, they are ready to upbraid the railways, denouncing them as robbers. Not all patrons adopt this course, and of those who do, not all really cherish the full spirit of their argument, but "every little helps" to influence the general spirit of your community one way or the other.

The local agent, being the most important and direct connecting link between the railways and the people, can do more toward disorganizing the attacks of politicians and newspapers, than can any other medium at the command of the company. The agent is the man who can get at the masses if he is of the right spirit.

The agent, in towns of any size, is in many cases one of the leading citizens. He is often a member of one or more of the civic bodies, probably active in the lodges, and his business as the railway representative brings him in contact with many people every day, and many of these people need an application of proper influence.

As an employee of your company, it is up to you to be a loyal and interested employee. If you are not loyal, it is because you do not like your job or your employer, and it is your duty to quit. Mail your resignation on the next train. This of course applies to every branch of the service, but in this article, I am talking about the agent. Therefore, if you have decided to continue in the service, forever hold your peace, and give the company the full benefit of your loyalty and good will. The company does not want you unless you do feel that way. The company wants capable and ambitious men, and there is always room for them ahead. While your present salary or environments may not be just as you would like, there is usually a reason for its status. Possibly you are not worth more. It is the right thing to ask your superior officers for a raise of salary or for improvements, but if they give you a refusal, it is because there are consistent reasons, and your way out is to improve your ability, and seek promotion from your present position.

Therefore whether you are receiving $30 or $300 a month, it is up to you to be satisfied. To be satisfied is to be loyal, and to be loyal is to further your company's popularity in every legitimate way. This point is brought out for the reason, that with every large corporation there exists a considerable faction of the employees commonly known as "dynamiters"—chronic soreheads and disturbers. They are a disloyal, unhappy, un-

satisfactory element. These individuals are not often found out at their true worth by the officers, for the reason that they mostly knock among themselves, and they are just smart enough to shut up when their superiors are around. As a usual thing, however, this disposition is reflected in their work and they rarely advance. It is merely a case of the law of compensation, and they are the real sufferers. Do you belong to this class?

Having pointed out the destiny of the "dynamiter," and shown why your present position should be interesting to you, I want to indicate what you should do or should refrain from doing to successfully transmit this happier state of mind to the people on whom the company depends for a livelihood. Right action on your part will be far reaching in results. When anyone comes into your office and berates the company on account of lost freight, late trains, legislation and what not at once, in a diplomatic way, defend your employer with plausible arguments. I have known many instances where the agent sided right in with the complainant, possibly because it was the path of least resistance, or because the employee happened to be a sorehead. This generates the wrong brand of influence and the patron hurries to gossip it with the next sympathizer. If you are the agent, your force hear you, and they naturally follow in your footsteps. I know of good sized stations where the entire force is always sore, while at other similar stations, where the conditions are the same or worse, the whole force are interested and happy, reflecting exactly the spirit of the agent. These do the most satisfactory work, and are by far the most appreciated by the officers. Does the grocer allow the public to come into his store and deride his service and his stock? Not much. Combat every attack by a courteous but firm counter argument for your employer. Point out the probable why and wherefore for lost and damaged freight, show that you will gladly make immediate effort to repair the wrong, explain how storage and demurrage are an obligation by law, as is also a switching charge. The people by their abuse of such privileges, are the very ones who brought about these conditions. In quoting service to patrons, do not promise anything not justified by the tariff. In other words, follow the tariff literally and keep within the law. I refer particularly to storage, switching charges and the like. In the long run this makes and retains friends for the company.

We cannot bear too strongly on courtesy and system, two positive elements most necessary in the local office. Courtesy includes a genial greeting on the street or in the office, prompt counter attendance, and an effort to aid and assist patrons and others with all the information possible. This makes friends for you and for the road. System includes organization. Your force and their work should be arranged so that there is a regular routine of duties with a place for every book and every blank. This facilitates changes in force when these are necessary, and aids the men to more readily concentrate their efforts; and they are much more contented. System, neatness, and cleanliness go hand in hand. If these are adhered to, your actual service to the public is of proper class, and is a business getter.

One thing more. Where there are two or more competing roads in your town, the several agents should form themselves into a Local Agents' Association, such as there are in large cities, for the purpose of agreeing on the interpretation of tariffs, and other points, so that each road will have all lawful privileges and no more.

These are the things you can do and should do. It is for your own benefit and for the benefit of your company. A moral obligation devolves on you. Be interested, loyal, ambitious, and such disposition will necessarily bring about a happy condition. It cannot be otherwise.

The first section of the Uruguayan branch line, which will eventually run from Nico Perez to Treinta y Tres, has just been opened. The section in operation extends between Treinta y Tres and Jose Battle y Ordonz.

WATERWAYS: THEIR POSSIBILITIES AND LIMITATIONS.*

BY FREDERIC A. DELANO.
President Wabash Railroad.

There is no more important subject today than that of waterways. It involves great questions of public policy, and every true and loyal citizen of the United States is interested in seeing those questions settled right—settled without reference to personal bias or party prejudice, and in a way justified by the conditions. All the facts upon which opinions must be based are facts for the engineer and the economist to determine after careful investigation. It is important that those facts should be accurately determined and correctly recorded. Therefore, in my discussion of this subject I shall endeavor to keep in mind these principles.

I do not believe that the development of waterways, solely in the interest of the general public, would hurt the railways. Even if I thought otherwise, I hope that I should have enough public spirit to advocate that which I believe to be for the general good. Whatever is for the public good ought to be done even if in consequence some special interest suffers. For the same reason that I do not think railway men should discuss such a large question of public policy from the railway standpoint, I do not think shippers should discuss it merely from the shipper's standpoint. The question that ought to be considered by all is whether development of waterways is the best way to secure cheaper and more adequate facilities for transportation; and when I say "cheaper," I have in mind the entire economic cost of transportation, including not only the rates that the shipper pays to the owners of the boats, but also what the public pays in taxes for the improvements and construction of the waterways.†

When we consider the cost of railway transportation, we do not consider merely the cost of moving the engines and the cars. We consider also the cost of providing and maintaining the roadway, the stations and other structures. Obviously, all costs incidental to the soliciting of freight, insuring it in transit, interest on capital invested, and charges for replacements and betterments are applicable to waterways as well as to railways; and we must not deceive ourselves by reason of the fact that some of these expenses are borne by the general government, instead of by the traffic moved.

TRANS-OCEANIC WATERWAYS—HARBORS.

The question of developing trans-oceanic waterways is mainly one of deepening harbors. Sea-going steamships have attained such draft that no harbor with a depth less than 20 to 40 feet can accommodate the largest of them. Any place that is to remain or become a great port must have a harbor dredged to these depths, for the large steamships make for economy in transportation, and only to such ports can the large steamships come.††

The development of harbors seems a proper, and even necessary function of the general government. Every commercial interest in the country (including railways) benefits by it; and for this very reason, private capital would have no incentive to engage in it, even if it were given the opportunity.

The increasing capacity and draft of sea-going vessels which necessitates the dredging of harbors to great depths, has a most

---

*An address before the Rivers and Harbors Congress, Washington, D. C., December 8, 1910.

†The public often ignores this expense and we have very little data in this country which is reliable. In Europe it is different. There the Governments endeavor to keep accurate information on such matters; and on the much used canals of Germany and France, that portion of the expense per ton of freight carried, by reason of interest on the first cost of the waterways runs from approximately one mill to four mills per ton mile.

††Ocean carriers may be roughly classified as follows:
(a.) Carriers of the first class, plying between the large ports of this country and Europe; 26 to 35 feet depth of draft;
(b.) Carriers of moderate draft, which may be classed as second grade —the better classes of "tramp" steamers and the less important liners; draft 16 to 24 feet;
(c.) Carriers of the third class—less important steamers and more common "tramp" steamers; draft 12 to 16 feet.
Obviously, harbor depths must be maintained with due regard to the class of business transacted.

important bearing on the question of the development of inland waterways. It is sometimes contended that we should dredge our rivers and dig our canals so wide and deep that vessels can carry goods directly and without trans-shipment between cities situated on them and all the ports of the world. Some of the people of Chicago have visions of ocean vessels loading in their harbor, steaming down through the drainage canal, the Illinois river and the Mississippi river, and thence to Europe; also through the Panama canal to the Orient; or by the Great Lakes and St. Lawrence canals, to Europe. Such thoughts are idle dreams, and the trend of economic conditions in ocean transportation make any such suggestions increasingly impossible. It might, for example, have been considered with the class of vessels which were used on the ocean twenty-five or more years ago. It cannot be considered with the class of vessels which are economical and necessary today, for, regardless of the relative depths of waterways, vessels which must withstand the buffetings of the waves and storms of the ocean must be built much more strongly and, therefore, at much greater cost than vessels for inland carriage. The average cost of an ocean steamship per ton of capacity is $71; of a steamship on the Great Lakes, $41.50; and of river tow boats and barges capable of carrying 10,000 tons of freight on an 8½ ft. draft, only $12.*

A lake or ocean vessel is poorly constructed for navigating a canal or tortuous river, even with a moderate current; its ratio of length to beam is too great and it cannot be maneuvered at slow speed. Furthermore, a vessel costing $71 per ton of capacity cannot be operated economically where it must, perforce, be navigated slowly.

COASTWISE ROUTES.

Trans-oceanic waterways are mainly connections, and not competitors of railways. The relations between the coastwise routes and the railways are widely different. In some cases, coastwise water lines compete with railways; in others, rail-and-water lines compete with railways; in others again, rail-and-water lines compete with rail-and-water lines.

It is often said that our merchant marine is declining. This statement is not strictly correct. The part of our merchant marine engaged in foreign trade is declining, the reduction in its tonnage between 1889 and 1909 being from 999,619 to 878,523 tons. But the tonnage engaged in our coastwise traffic increased between the same years from 3,211,416 to 6,451,042, or over 100 per cent. This increase is mainly attributable to three things:

(1) To the monopoly of the coastwise traffic which the government gives to American vessels, and but for which it is improbable that our ships would have been able to meet the competition of foreign vessels any better in our own waters than the high seas.

(2) To the fact that many large industrial concerns have acquired and operate lines of boats to handle their own traffic; and

(3) To the fact that many railway lines have acquired coastwise steamship lines, or at least controlling interests in them, make favorable through rates and issue bills of lading in connection with them, and use their own soliciting staffs or other well developed soliciting organizations to get traffic for them.

There is much criticism of the railways for getting control of steamship lines engaged in coastwise and lake traffic. But experience indicates that the control of such steamship lines by either large industrial corporations or railways is requisite to the development of a larger water traffic. A railway can go anywhere that traffic is available. A steamship line can skirt only the fringe of the country, and can touch that fringe at only a few places, the number of harbors capable of receiving a good-sized boat being much smaller than the number of stations on a railway. The amount of freight originating at the relatively few places at which a steamship can be docked is comparatively small. Before it can get a large and regular traffic, some agency must cause commodities to be laid down at places where it can pick them up. A large industrial corporation, such as the Standard Oil Company, the United Fruit Company, or the United States Steel Corporation, can cause a great amount of freight to be concentrated at points where its own boats stop. A railway with a soliciting staff represented at every point on 2,000 to 5,000 or even 10,000 miles of line, may similarly cause enough freight to be concentrated at certain places to make profitable the regular operation of large steamship lines from those places. But—except under conditions peculiarly favorable to water transportation—a steamship line which has not the co-operation of a large industrial concern or a large railway cannot get traffic with such regularity and volume as to enable it to compete effectively, permanently and on a large scale against well-organized railways having strong soliciting staffs and giving regular and dependable service.

In an admirable book by Professor Smith, of the University of Pennsylvania, called "The Ocean Carrier," the great vicissitudes surrounding ocean transportation are pointed out. The business is essentially very hazardous and must either be done on a very large scale in order to distribute the risk, or be backed by very powerful corporations. Marine disasters or lean traffic years are overwhelming to any small vessel owner, even though the profits of an occasional good year are sometimes very large. Coastwise water transportation, like other ocean transportation, is cheaper than rail transportation, and when its lower cost is supplemented by efficient steamship management it is of great economic benefit. In Europe it is common for the railways to make practically as low rates per ton mile for short distances as for long distances. While this does not agree with the economic principles of transportation, it serves to make the railways valuable as feeders for the waterways, because the railway with relatively high long distance rates cannot compete with the waterway, whereas the comparatively low *short* distance rate enables them to act as assembling agents for the waterway.

THE GREAT LAKES.

The most rapid growth in our water-borne commerce during the past twenty years has been on the Great Lakes. Between 1889 and 1906 the gross tonnage of vessels used on the Mississippi and its tributaries increased 31 per cent.; on the Atlantic Coast and Gulf of Mexico, 82.5 per cent.; on the Pacific coast, including Alaska, 133.3 per cent.; on the Great Lakes and the St. Lawrence river, 160 per cent.; and meantime the gross tonnage of the vessels used on our other inland waterways declined 74 per cent. During the same period the net tons hauled on the Great Lakes and the St. Lawrence river increased 200 per cent.; on the Atlantic coast and the Gulf of Mexico, 166 per cent.; on the Pacific coast, including Alaska, 57 per cent.; and the net tons hauled on the Mississippi river decreased 6 per cent., and on all other inland waters, 65 per cent. The rapid growth of commerce on the Great Lakes has been largely due to the wise policy of the government in developing harbors and in deepening the Sault Ste. Marie canal. It has also been largely owing to the course of large industrial corporations and of the railways in acquiring control of or putting on the Great Lakes large steamship lines. These things have contributed to its increase for precisely the same reasons that they have helped to stimulate our coastwise traffic.

You may be disposed to reply that the important thing that has built up the coastwise and lake traffic has been the very low rates which the water lines have made. It is true that their rates have been much lower than those by rail. But the fact is that a water line which seeks to attract business from a competing railway merely by low rates is very apt to get worsted. This is illustrated by the existing conditions on the Great Lakes. The report of the Bureau of the Census on Transportation by Water, issued in 1906, from which many of the statistics that I have cited are derived, shows that the total shipments on the Lakes in 1906, excluding bunker coal, were about 73,000,000 tons, and that of this amount about 43,000,000 tons were iron ore or its products, practically all of which, of course, was carried in vessels owned by large industrial corporations—the steel manufacturers. Of

*A modern freight car costs approximately $20 per ton of capacity.

the rest of the traffic, very much the greater part was carried in vessels owned by coal operators, lumbermen, and railways, leaving only a comparatively small part for other boat lines. Practically all of the shipments of package freight were carried by railway boat lines. While the traffic on the lakes has been increasing so rapidly, that of the railways running between the same points that are reached by the boats has increased even more rapidly. Why have not independent boat lines taken the business away from the railways and the water lines they control? There are independent water lines and they make low rates. The answer is that the railway (and substantially the same thing is true of water lines controlled by railways) has a soliciting force and offices everywhere that are accessible to the shipper and when he delivers it goods it issues him a bill of lading which is a merchantable and bankable paper and most absolutely protects him against loss of and damage to his goods, while when he wants to make a shipment by an independent boat line he has to go and hunt up a captain who may have two or three boats available, and who will give him a mere receipt for his goods which affords him little or no protection against loss and damage. To be on the safe side, he must incur the trouble and expense of insuring the goods while in transit. Even if he can save a small amount, this will not compensate him for the trouble and time of hunting for someone to carry his goods and for the risk incidental to water transportation. Indeed, it is safe to say that not to exceed 20 per cent. of the tonnage carried on the Great Lakes is carried by *common carriers*. The railway steamship lines, and half a dozen or more independent lines, are common carriers; but the great bulk of the tonnage is carried by vesesls owned by the shippers or by "tramp" steamers that are chartered to the shippers.

As already stated, the railway has the great advantage that it can send for goods anywhere, pick them up anywhere, and carry them without trans-shipment to any point to which the shipper may. want them to go. No independent boat line can attract business away from a steamship line owned by the same industry whose commodities it transports; and it is also difficult, although not so hard, to attract traffic away from a boat line owned by a railway, because the railway can to a very large extent influence the routing of traffic which may be carried by its boat line. Even if an independent boat line builds up a good business, there is nothing to prevent some rival boat line coming in, cutting rates, and taking a large part of it away; for it is easy for a group of men to get together a fleet of vessels by charter and form a line to compete for any traffic; but the vulnerability of independent boat lines tends to prevent them from being established. In other words, the very freedom of waterway competition militates against waterway competition.

It is chiefly due to these conditions that the boat lines on the Great Lakes have in the main passed into the control of the large industrial corporations and the railways. One of the results of their control by these large interests is that the public has to rely for water transportation mainly on the lines controlled by railways; for the steamships owned by the large industrial corporations are private carriers and handle only commodities shipped by their owners. Therefore, if the public gets any of the benefit of the low rates they make, it is only in the form of low prices for the commodities they sell. Whether the benefit is passed along to the ultimate consumer in this form, I must leave to your own observation.

CANALS CONNECTING GREAT WATERWAYS.

No wiser and more effective expenditure of public money for waterways could be made than for the purpose of deepening and widening rivers and digging canals to connect large bodies of water when the distance between the waterways is not too great. The best example in the world of such connecting canals is the Sault Ste. Marie canal. The American canal at Sault Ste. Marie was first opened to navigation in 1855. During the forty years to 1895, 101,244,462 tons of freight passed through it. During the next 11 years, ending in 1906, after the canal was improved, 343,288,393 tons passed through it. The development of this canal, which is 2.7 miles long and 25 feet deep, has cost $13,000,000, or $4,800,000 per mile. Its great value consists not merely in its ability to handle a large traffic, but in the fact that it makes more available and useful the great waterways it connects. Its cost was large, considering its length, but all the great ship canals have cost very large sums. The Suez canal, which also was built to connect great waterways, is nine miles long, 31 ft. deep, and cost over $1,100,000 per mile. The Kaiser Wilhelm canal, 61 miles long and 29½ ft. deep, cost $656,000 a mile. The Manchester Ship canal, 35.5 miles long and 26 ft. deep, cost $2,100,000 per mile. These very large figures show that the longer it is necessary to make a ship canal to render it useful, the more dubious becomes the desirability of building it. When it must be made more than a comparatively few miles long, its cost is apt to become so very great as to make it an entirely uneconomical means of transportation if to the rate paid by the shipper is added an allowance for interest, maintenance and depreciation on the original undertaking.

This subject should not be passed without mentioning our splendid undertaking at Panama. True, this undertaking may cost from eight to ten millions per mile of canal, but as an undertaking for the benefit of the world at large, it is one of the greatest ever conceived. No one can foresee the economic effect which may flow from the Panama canal. We can see its military value to us. We can see that it will bring the Pacific coast nearer to our Atlantic seaboard; but, by the same token, it will also give our European competitors easier access to our Pacific markets. We can readily see that it will be an advantage as a new route for the manufacturing centers on our east coast to the west coast of South America, and between our own west coast and the east coast of South America. Incidentally, an interesting effect of the Panama canal will be to sound the death knell of the last great sailing vessel world route—that from San Francisco to Europe. The tramp steamer plying through the canal will certainly put the last of these "wind-jammers" out of business.

NAVIGABLE RIVERS.

A widespread public demand for the general improvement of the navigable rivers of the United States has been voiced within recent years. This demand is generally premised on the assumption that the greater commercial use made of the rivers of Europe is due to their having been developed by the governments to a greater extent than our rivers have been, and that similar action by our government is necessary to make our rivers equally useful transportation facilities. But the fact is that our navigable rivers in their present condition are better able to carry a large traffic than are those of Europe. The maximum depth attained on the rivers and canals of France is 8.5 ft., while most of the traffic is carried on water varying in depths from 1.5 to 5 ft. The depths of the rivers in Germany vary from 3 to 6 ft., except on the lower reaches of some of the larger streams, where there are depths of from 8 to 10 ft.; and the canals and canalized rivers vary from 2.6 ft. to 10 ft., 4 to 6 ft. being most common. The Rhine and the Elbe, on which 67 per cent. of Germany's water commerce is carried, have together only 617 miles of channel, with a depth of as much as 4½ ft., which is the minimum depth of the Mississippi, the Illinois river and the Illinois state canal between Chicago and New Orleans, a distance of 1,657 miles. There are in the United States 40 streams, with a length of 2,600 miles, which have a depth of 10 ft.; and 70 more, with a length of 3,200 miles, which have a depth of 6 to 10 ft. Practically all the traffic on the waterways of Belgium, France and Germany is carried in shallow barges varying in capacity from 100 to 1,000 tons. One thousand ton barges are practically confined to the Rhine in Germany and the Seine in France. The great bulk of the traffic is carried in barges having drafts of 2 to 6 ft. and capacities of 150 to 600 tons, and which are commonly towed in trains at from 2½ to 4 miles an hour. It would be perfectly feasible to handle

a big traffic with such barges as these on a very large proportion of the rivers of the United States. If some of our rivers, such, for example, as the Hudson, which has ample depth and width for navigation by large vessels, and which runs in the direction of large currents of traffic, were located in Europe, they would be bearing a heavy commerce.

The main reason why the commerce on our navigable rivers is so much smaller than on those of Europe is not that our rivers are potentially less efficient facilities of transportation, but that our railways are more efficient than their railways and make lower rates. The average rate per ton per mile on the railways of France is 14 mills, and on those of Germany, 13 mills. It is not possible to state the average rates per ton per mile on European waterways, but the figures given in the report of the British Royal Commission on Canals and Waterways, which was published early in the present year, indicate that the average rate per ton per mile on the waterways of Germany is about 5 mills, and on the waterways of France about 6 mills. This takes no account of the fact that in Europe the haul by water between any two points is usually considerably greater than the haul by rail. If the water rates were estimated on the basis of the shorter distances by rail, they would be higher, but they would still be much lower than the rail rates. The governments of continental Europe so regulate the rates of the railways as to make them rather inflexible, while the boats are allowed to give all the flexibility to their rates necessary to secure business. In view of these differences in the water and rail rates of Europe, it is not surprising that the boats on the rivers, despite their relative shallowness, have been able successfully to compete against the railways.

Railway rates in the United States are very much lower than they are in Europe. The average railway rate per ton per mile in this country in 1909 was but 7.63 mills, and the rates on roads having great densities of traffic, or handling mainly cheap and bulky commodities, are much lower.*

The average rate per ton per mile on all traffic of the Pennsylvania Railroad, for example, is 6.3 mills; of the Illinois Central, 5.8 mills; of the Lake Shore & Michigan Southern, 5.27 mills; and of the Chesapeake & Ohio, 4.33. Furthermore, our railways have been allowed in the past freely to adjust their rates so as to meet water competition, and even destroy it.

The policy of both the railways and the government of the United States in reference to railway rates recently has been changing to a marked degree. Until lately, the tendency of railway managers was voluntarily, or under the stress of fierce competition, to reduce rates to a lower and lower basis. This unrestrained competition caused unfair discrimination between localities. The efforts of the government and of the railways to stop unfair discrimination necessarily have reduced competition, and thereby checked the downward tendency of rates. The increasing costs of railway operation have had a similar effect. If railway managers are allowed to carry out their present plans, rates will be advanced somewhat. Furthermore, the Mann-Elkins act has amended the Interstate Commerce act in ways that will tend to prevent the roads from meeting water competition as they have in the past. They often have made lower rates for longer, than for shorter hauls, in order effectively to meet at points on navigable rivers, competition which did not exist at intermediate points. If they had been required to reduce all their rates to the same basis as those made to meet such competition, they would not have tried to meet it. Under the revised Interstate Commerce act the commission is given wide discretion to determine when a railway may make a lower rate for a longer haul; and according as the commission exercises its discretion will depend how and to what extent the roads may in future meet water competition. Another provision of the Mann-Elkins act absolutely prohibits a railway from raising a rate that has been reduced to meet water competition, unless since the rate was fixed some change in conditions has occurred other than the elimination of water competition. This restriction on advances in rates is sure to operate as a hindrance to their reduction. With railway rates tending upward, rather than downward, and also tending to become less flexible, it is quite possible that the opportunity for the development of traffic on our navigable rivers is improving.

*This oft-quoted figure of the average ton mile rate in this country is made up by taking the average of all the tonnage of the country. It includes the movement of less than carload package freight; the movement of business over mountain ranges where the rates are necessarily high; it includes the movement of live stock, perishable freight, citrus fruits, and many high class commodities on which speed is a requisite.

CANALS AND CANALIZED RIVERS.

A great many intelligent persons concede that the traffic on the inland waterways of the United States, except the Great Lakes, has declined, while that on the waterways of Europe has increased, because of the cheap and superior service of our railways, and contend that we can make our waterways successful competitors of our railways only by making our waterways greatly superior to the waterways of Europe. They, therefore, advocate digging canals and canalizing our rivers to depths exceeding those attained on such waterways in any other country. One of the plans is for a 14 foot waterway from Chicago to New Orleans. It is questionable if the results would be worth the cost. The aim of public policy should be to cause the provision of such facilities of transportation as will be able to handle our commerce at the least economic cost; and in economic cost I include the taxes the public would have to pay in order to provide and maintain deep waterways. The report of the British Royal Commission shows that the expenditures of France on its rivers up to 1905 averaged $30,000 a mile, and on its canals, $102,675 per mile. The average density of traffic on French waterways in 1905 (that is, the number of tons handled one mile per mile of waterway per year) was 420,000 tons. Germany had spent on its waterways an average of $30,300 per mile, and on its canals, an average of $42,250, and the average density of traffic on them was 1,500,000 ton miles. The canalization of the Main cost $95,000 per mile. The construction of the Teltow canal cost $390,000 per mile. The interest and maintenance charges paid by the government of France on its waterways amounted to 4.2 mills per ton mile of traffic handled, which, added to the average rates which the shippers paid to the boats, *makes the economic cost of water transportation ten mills.* The interest and maintenance charges paid by the government of Germany amount to about .84 mills per ton mile, which, added to the average rate of 5 mills, makes the total economic cost of water transportation almost 6 mills. The greatest density of traffic on any river in Europe is on the Rhine, where it amounts to 11,400,000 ton miles. To get the depths advocated in this country would require very much greater public expenditures than those that have been made in Europe. Indeed, it might in many cases involve expenditures approximating those for the Kaiser Wilhelm and the Manchester Ship canals, the former of which cost $656,000 per mile, and the latter $2,100,000.

The capitalization of the railways of the United States is $59,259 per mile of line, and this, of course, includes equipment and terminals, as well as roadway. The number of tons carried one mile per mile of line by our railways in 1909 was 953,986. The density of traffic of some of our large railways rivals that of the greatest waterways of Europe. The number of tons hauled one mile per mile of line by the Delaware, Lackawanna & Western in 1908 was 3,886,814; by the Philadelphia & Reading, 4,164,131; by the Pennsylvania Railroad, 4,723,834; and by the Bessemer & Lake Erie, 5,564,712, or over 13 times as much as the average density of traffic per mile on the waterways of France, and almost four times as much as on the waterways of Germany.*

These figures indicate to my mind that if, in order to provide inland water transportation which will be able to compete effectively against the railways, it is necessary to dig canals and to canalize rivers to depths of 14 or 20 feet or more, we might better

*A density of three million tons of freight per mile of road on single track lines is not at all uncommon in the United States, and this movement is in addition to a very considerable passenger traffic.

forego having effective water transportation facilities and use our money to provide facilities for transportation by rail.

To dig a waterway 14 feet deep would be to provide one that would not be any more useful than the Mississippi river already is for most of its length and than numerous other streams are. For over 95 per cent. of the vessel tonnage on the Great Lakes draws over 14 feet of water, and over 80 per cent. of this draws over 18 feet. It is evident, therefore, that lake vessels could not be used on a 14 foot waterway, and, of course, ocean steamships could not be used where lake steamships could not be. Even if the Lakes-to-the-Gulf waterway were made sufficiently deep for lake vessels, and it were economical for them to use it, all water transportation on tributary streams would have to be carried in shallower draft vessels, requiring transfer. Would it not be better to serve the entire Mississippi river basin with tow boats and barges which, like the much abused freight car, could go anywhere within the sphere of navigability, say 5,000 to 8,000 miles? Isn't the real problem to find an economical vehicle of transportation adaptable in a large river system like the Mississippi River and its tributaries; a vehicle which shall do for that river system what the freight car does on our system of railways?

The stern reality is that even if a 14 or a 21 foot waterway were dug, it would never be used by deep draft boats. As I have already said, a large vessel cannot be profitably navigated on a narrow channel, because the interest on its high cost makes it uneconomical. Colonel Symons estimated that it would cost 38 per cent. more to carry grain with a lake freighter on a ship canal than it would with a tow boat and barges, and it was in consequence of his investigations and conclusions that the state of New York decided to deepen the Erie canal only to 9 feet, instead of making a ship canal of it. Colonel Symons' estimate did not allow for the greater cost of building and maintaining ship canals, but referred only to the expense that would be incurred by the owners of the boats. The operation of a deep draft vessel in a river channel having any considerable currents might be even more expensive than on a ship canal.

Furthermore, I assume that no one would advocate making not only the Mississippi, but all of its navigable tributaries, 14 or 20 feet deep; yet if the Mississippi were made a deep waterway while streams emptying into it were not, even if it proved practicable to navigate deep draft vessels on the Mississippi, they could not be navigated on the tributary streams, and then one of two things would happen—either the vessels in which goods were loaded on the smaller streams would be sent through to destination with the goods—in which case the deep draft vessels would not have them to haul—or the goods would have to be transferred to the deep draft vessels, and transferring goods from boat to boat is as expensive as, and often even more expensive than transferring them from car to car. It seems to me that to develop a waterway system in this way would be like building the main line of a railway with a broad gage and the branches with a narrow gage; So far as I can learn, it is the opinion of practically all of the United States army engineers who have investigated the subject, that a tow boat with 6 or 9 feet draft, towing barges with a combined capacity of 8,000 or 10,000 tons, would be able to handle traffic cheaper on the Mississippi river, even if it were deepened 14 feet or 21 feet, than could a lake vessel with a deep draft; and the tow boat and barges would be able to navigate many of the shallow tributaries as well as the Mississippi, which would avoid the cost of transferring freight originating on the branch rivers. Needless to say, the cost of dredging the Mississippi river and its tributaries to a minimum depth of 6 feet or even 9 feet, and maintaining that depth, would be very much less than the cost of digging it to a uniform depth of 14 feet. It would seem, therefore, that all that reasonably could be asked, or that ought to be asked of the general government, so far as our navigable rivers are concerned, is that it shall dredge them to depths sufficient to accommodate towboats and barges such as can now be operated on the greater part of the Mississippi river drainage system. To do more than this would involve an expenditure which would not be justifiable—which, in other words, would not make the *total* cost of water transportation less than it is by rail, whether it made it cheaper for the shipper or not.

If the government provided such channels as I have indicated; if the municipalities or private corporations provided modern and adequate water terminals; and if the water lines made rates, gave service, and formed soliciting staffs adapted to competing effectively with the railways, the water lines on our rivers would be as well situated to compete with railways as are those on any waterways in the world, except, of course, the oceans and the Great Lakes; and unless good water terminals were provided and the steamboat companies formed soliciting staffs, issued bankable and negotiable bills of lading and in other ways gave service which was as good in proportion to the rates charged as that of the railways, they would be as unsuccessful in competing for business, even if the government dug the rivers 20 feet deep, as are the independent boat lines on the Great Lakes now in competing with the railways or with the steamship lines owned by the railways and large industrial corporations.

I do not say that if all these things were done, river steamships would be able to compete successfully against the railways, and I feel very sure that if the water lines were subjected to the same kind of regulation as the railways are, they would continue for an indefinite time to be unable to compete with the rail lines.*

I merely say that under any circumstances *these* are conditions that must be met if our *inland waterways* other than the Great Lakes are ever to compete successfully against the railways. Whether, when the results that would be obtained are so entirely problematical, it is worth while to go on and spend millions in dredging the rivers and equipping water terminals, is for the public to decide.†

Up to 1907, the government had spent over $208,000,000 on the improvement of the Mississippi valley waterway system alone. Between 1880 and 1906, canals and canalized rivers having a length of 2,841 miles, which had cost $73,168,000, were abandoned. Up to that time our total expenditures on canals and canalized rivers had been $283,208,863. The total Congressional appropriations for the survey, improvement and maintenance of harbors and waterways had been $552,943,525, and many millions of dollars have also been spent by the various states. We all know that a large part of these expenditures has been unwise, and certainly before expenditures are entered on which would be very much greater than any made in the past, the projects on which it is proposed to make them should be studied to much better purpose than like projects have been in the past.

---

*Although I have never seen the statement made, I believe it is a fact—and one worth determining by careful test—that it takes less power to move five thousand tons, or ten thousand tons of freight loaded on cars, on a railroad the grades of which do not exceed three-tenths of one per cent., than to move the same tonnage on a canal or canalized river. Train resistance on a smooth and level track is less than the resistance of moving a boat through water.

The reason that the public have been misled as to the comparative cost of rail transportation and water transportation is that in the case of rail transportation the shipper pays the entire cost, including terminal service, and on top of this cost, a profit to the transportation company, whereas in the case of water transportation, the shipper pays only the bare cost of carriage, and no interest on the money invested in the waterways, in the harbors and terminal improvements, nor in the maintenance and upkeep of the waterways.

Furthermore, the interruption of water transportation in our Northern waters is more than a serious inconvenience. It puts the burden of heavy interest charges for the entire year upon the traffic which can be handled only in the summer months.

†A fact often overlooked in considering the cost of transportation as a whole, between producer and consumer, is the cost of assembling freight at the initial point or distributing it at terminal points. In this respect, while the railways have a great advantage, yet even with the railways, the cost of assembling farm products in many of our states (as pointed out in a recent report of the Department of Commerce and Labor) is greater than the freight paid by the farmer from his initial station to the point at which he markets his produce. In other words, a farmer who has to haul his produce eight miles to a railroad station, at a cost of, say twenty cents per ton mile, is spending as much as he would pay the railroad for two hundred and ten miles of transportation at the average rates prevailing over the whole country.

Thus, it is fair to expect that good roads and automobile trucks will contribute much in the future towards cheapening the cost of assembling and distributing freight; and that there is much to be gained by intelligent public expenditures in the direction of improving the public highways and so reducing the cost of haulage to and from shipping points, whether these shipping points be stations of railways or of waterways.

Shop Section.

THE general shop kink competition, announced to close January 15, will include kinks of all kinds used in connection with the maintenance and repair of cars and locomotives. A prize of $50 will be awarded for the best collection of three kinks and a prize of $25 for the second best collection. Contributors may submit more than three kinks, allowing the judges to base their decision on what they consider to be the best three in each collection. Kinks not awarded a prize, but accepted for publication, will be paid for at our regular space rates.

A CAR department competition, an extended announcement of which was made in the *Railway Age Gazette* of December 2, will close on February 15. The only requirement is that the paper submitted cover some subject or subjects of interest and importance to the foremen of the car department. Obviously, the more practical the paper the greater its value. You have gained splendid results in doing a certain class of work, or from a piece of equipment, or by changing your methods or the material, or by devising new arrangements for manufacturing or assembling it. Tell us clearly just what you did and the results obtained. Every foreman has interesting and valuable information concerning the work of his department which will be helpful to his fellows. It is just this sort of material that we want to bring out. The length of the article was not specified in the announcement which was made last month. Make it just as long or as short as you think best in order to tell your story clearly. The best paper will be awarded a prize of $35 and the second best a prize of $20. Papers that are not awarded a prize but are accepted for publication will be paid for at our regular space rates.

ANOTHER engine house kink competition will be held, to close March 15. The results of the first competition of this kind appeared in the October Shop Number and were exceptionally good. However, this is a large field and there are very few engine houses that do not have good kinks which have not yet been illustrated. A prize of $35 will be awarded for the best collection of two kinks and a prize of $20 for the second best collection. More than two kinks may be submitted, allowing the judges to base their decision on what they consider to be the best two in each collection. Kinks accepted for publication, but not awarded a prize, will be paid for at our regular space rates.

THE four papers submitted in the competition on Increasing Shop Output, which are published in this number, come from four entirely different sources, and, as might be expected, differ from each other greatly. The first prize article, coming from Mr. Burrhus, an assistant to the general foreman, is practical, showing exactly how the output was greatly increased at one shop without increasing the cost of operation. Mr. Perritt, a blacksmith foreman, tells of the different factors which he has found of value in improving the efficiency of a smith shop by increasing the output and at the same time reducing the number of employees. Mr. Maier, an enginehouse foreman, in his article on Lost Motion, emphasizes the importance and necessity of having what might be termed a clearing house for improved shop methods on roads which have a number of repair shops and repair yards. This has been tried with a certain degree of success, but not to the extent proposed by Mr. Maier. For the first time since we have inaugurated the competitions in the Shop Numbers a contribution has been received from Mexico While Mr. Stone does not belittle the effect of shop kinks and similar methods of handling the work in detail, he does believe and tries to emphasize the greater importance of improved organization and its effect upon shop output.

THE first prize of $35 in the competition on Increasing Shop Output, which closed December 15, has been awarded to H. L. Burrhus, assistant to the general foreman, Erie Railroad, Susquehanna, Pa. Mr. Burrhus has clearly outlined some of the more important methods which were used in increasing the output of the shop with which he is connected 50 per cent. in one year without any increase in the cost of operating as compared to the previous year. The second prize of $20 has been awarded to W. C. Reyer, general foreman, Nashville, Chattanooga & St. Louis, at Nashville, Tenn. Mr. Reyer's paper will be published in the February Shop Number, and describes in detail a number of changes that have been made at his shop within the past eight months which have greatly increased the output without a corresponding increase in the cost of operation. The six other contestants all presented first-class papers. They were C. J. Crowley, piecework inspector, Chicago, Burlington & Quincy, West Burlington, Iowa; H. Holder, general foreman, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.; Charles Maier, enginehouse foreman, West Jersey & Seashore, Atlantic City, N. J.; J. F. Perritt, blacksmith foreman, Seaboard Air Line, Jacksonville, Fla.; W. H. Snyder, assistant general foreman, New York, Susquehanna & Western, Stroudsburg, Pa.; and C. E. Stone, general car foreman, National Railways of Mexico, Talleres de Santiago, Mexico, Mex.

W. H. SNYDER, assistant general foreman of the New York, Susquehanna & Western, Stroudsburg, Pa., has been awarded the first prize of $35 for the best collection of two kinks submitted in the car repair kink competition which closed November 15. C. C. Leech, foreman of the Pennsylvania Railroad at Buffalo, N. Y., has been awarded the second prize of $20. In announcing the names of the contestants in this competition in the *Railway Age Gazette* of December 2, Mr. Leech's name was omitted by mistake and that of S. S. See, of the Norfolk & Western, was substituted. Mr. See did not, however, enter the competition. The other three contestants, A. G. Pancost, draftsman, at Elkhart, Ind.; F. Rattek, of Brighton, Mass.; and Theodore Rowe, general foreman of the Jackson street shops of the Great Northern at St. Paul, Minn., are all entitled to considerable credit, as will be seen by examining the contributions which are reproduced in this number. The judges had considerable difficulty in awarding the prizes. In doing so they took into consideration the different car repair kinks which have appeared in the *Railway Age Gazette* during the past six months, some of which were practically duplicated by contestants in the competition which has just closed.

A MECHANICAL department officer, who has had many years experience in shop work, beginning at the bottom, and who has been more than ordinarily successful as a shop superintendent, had this to say in discussing the matter of scientific management: "If you will take all the improved machinery, improved shop facilities and equipment, high-speed steel, individual motor-driven tools and improved methods, and will place them on one side, and on the other hand have a man who thoroughly understands the handling of men—if I had to choose between them I would far sooner have the latter than the former. As a matter of fact, the results in greater output and higher efficiency under the direction of such a man without up-to-date facilities would be far greater than all the modern facilities you could provide, without such a man. That is one of the reasons why the betterment or efficiency engineers have failed. The methods which they propose and the basic principles upon which they work are all right, but they do not seem to know how to supplement this by developing men who are capable of handling men."

SCIENTIFIC MANAGEMENT.

Of those who testified on scientific management in connection with the freight rate hearing before the Interstate Commerce Commission at Washington in November, two, Harrington Emerson and H. L. Gantt, were professional efficiency engineers. Most of the others were connected with manufacturing concerns, including James M. Dodge, chairman of the Link-Belt Company; Henry R. Towne, president of the Yale & Towne Manufacturing Company.; H. L. Hathaway, of the Tabor Manufacturing Company; H. V. Scheele, head of the planing department of the Brighton Mills; John R. Williams, a printer, of New York; and Frank B. Gilbreth, a contractor, of New York. Of those who testified only one, Mr. Emerson, has had extended experience in railway work. Mr. Gilbreth, as a contractor, has done work for the railways, and Mr. Gantt has had some experience as a consulting expert with one road, but hardly enough—possibly three days a month for a year or less—to qualify him as an expert in that line of work. The other gentlemen all testified as to the results which had been gained in their manufacturing plants by the introduction of scientific management principles. Apparently none of them were at all familiar with repair work in the mechanical department of a railway. Judging by the results obtained in their own plants, as testified to by the above-mentioned gentlemen, conditions must have been pretty bad in some of them before the efficiency work was inaugurated. The basic principles underlying scientific management are correct. We believe in them absolutely and that great savings are possible where they are properly applied. The trouble has been that the efficiency engineers, although they have grasped these principles and formulated them, have not understood how to apply them. Mr. Emerson, for instance, was given a fair trial in the mechanical department on the Santa Fe (three years) and claims to have saved the road $5,000,000 in that time. We do not wish to question his sincerity in making this statement or his method of calculating these results. Suffice to say that many of us, and among them some of the men who were associated with him in the work, have studied the annual reports of the Santa Fe carefully and have been unable to check this result.

Mr. Emerson has been exceedingly frank in telling those in charge of the operation of railways that they were extremely wasteful. Surely he will not object if, with equal frankness, and in a calm, friendly, unprejudiced manner, we try to point out where he has made mistakes in applying his principles. Moreover, in drawing attention to the most important defect, let us base it on part of his own testimony at Washington. Possibly no feature of that testimony has given Mr. Emerson more satisfaction than the telling of one of his own experiences at the Railway Club of Pittsburgh. In his paper on the Fundamental Principles of Efficiency presented before that club, he directed attention to a road that maintained its freight cars at the low unit cost of $37 per year, and criticized other roads which maintained their cars at a higher cost. Mr. Emerson says that L. H. Turner, superintendent of motive power of the Pittsburgh & Lake Erie, criticized this figure as being entirely too low, and then went back to his office and found that his own road was maintaining cars at a cost of $31.01 per year; the inference being that Mr. Turner did not know what his own road was doing. Benjamin Baker, in commenting on this incident in the current number of the *Review of Reviews,* has this to say:

"In all parts of the railway business outside of the traffic department, exceedingly few of the higher railway officials are entitled to be called experts. Their occasional utter failure as accountants is certified by such things as the coal graft on the Pennsylvania and the recent car repair scandals on the Illinois Central; more humorously by the case of the railway vice-president, named in Mr. Emerson's testimony, who declared at a meeting of the Railway Club of Pittsburgh that an annual cost of $37 for freight cars was an absurdly low estimate—only to find when he overhauled his own figures that his own road was doing it for $31.01. These higher officials are not prevailingly mechanical engineers, civil engineers or fuel experts, and had they the professional training of such men, they have not had the time, and rarely the inclination, to master the mass of detail that is necessary to the mechanical engineer who undertakes to make a specialty of scientific management."

Mr. Turner's discussion at the Railway Club of Pittsburgh does not warrant drawing any such conclusions concerning his knowledge of the cost of repairs to freight cars. Because this incident has been so widely quoted, it may be well to tell exactly what happened, as reported in the official proceedings. Mr. Emerson made the statement that "one railway in the United States maintains its freight cars for $37 per year. Another one in similar service spends over $100. The $37 cars cost $100 less to build and weigh 6,000 lbs. less for the same capacity. At $37 on 50,000 cars there is an annual saving of $3,150,000 in maintenance cost alone below the rival figures." In discussing this paragraph Mr. Turner said:

"Men employed as managers of mechanical departments of railways are in self-defense and in justice to themselves bound to take exception to some statements made and figures given in Mr. Emerson's paper. For instance, he states that one road maintained its cars for $37 each per year. Freight cars are making about 8,400 miles per year; this brings the cost per car mile for repairs to $0.043, and it is stated that these cars were 6,000 lbs. lighter and cost $100 less to build than those of another road that spent $100 per year for maintenance. This seems inconsistent, as weight in a car, if properly distributed, adds strength and will reduce the cost of maintenance. The light car should ordinarily cost more to keep it going. It is safe to say that $0.070 per car mile is a very fair average figure for maintenance throughout the country. While the figures given are undoubtedly correct, a statement should have been made as to the conditions under which the two roads were working. The $37 man may have had a lot of new equipment, or may have been slighting his work, while the $100 man possibly had a lot of old equipment, badly run down, and may have been trying to build it up and do the work that his predecessor had neglected."

Those of us who have worked under Mr. Turner, or have been intimately associated with him, realize that he never spent a dollar of his company's money unless he was reasonably sure that it was going to bring good returns, and that the equipment on the Pittsburgh & Lake Erie is maintained and operated in a most efficient manner. On the other hand, he is big enough and broad enough to look into any new device or method which may be brought to his attention, and to adopt it if it can be shown that it will make a saving or improve conditions in his department. Mr. Emerson undoubtedly selected the figure, $37, as being the lowest one he could find for a standard to work to. What qualities, then, in Mr. Turner, have made it possible for him to at least equal, and possibly better, the standard of the efficiency engineer? Roughly and briefly Mr. Turner possesses two qualities which Mr. Emerson does not, and which are largely responsible for his success—he understands men thoroughly and knows how to handle them, and he is diplomatic. These far outweigh the value of Mr. Emerson's scientific management principles, and, include many of them which Mr. Emerson has stated in such a mechanical manner as to be hardly recognizable in the practical, common sense way in which Mr. Turner applies them. The efficiency engineer, in almost every case that has come under our observation, seems to lack both the knowledge of the handling of men and the diplomacy that is to be expected from those who step in and tell the other fellow how to run his business.

* * * * *

No one who knows Mr. Emerson will accuse him of stupidity. In starting in his work on the Santa Fe he established certain attainable standards. Where did he get them? Largely from the records of the mechanical department of the Chicago & North Western. This road has never employed a so-called efficiency engineer or formulated any fundamental principles of efficiency. Why, then, should its records be so far ahead of others that an efficiency engineer should adopt them as a goal towards which to work? Surely its shops were not modern! It had no bonus system, and as a matter of fact, it had not even piece work. Its men were and are paid by the day. Yes, but it did have at its head Robert Quayle, a man who understands men and knows how to handle them, and he has had more of the same type of men under him. True, he has numerous other qualities which in a smaller degree are responsible for his success, but this one far outweighs all the others.

Mr. Emerson must be given credit for good work on the Santa Fe. Many of his ideas are good, and had they been coupled with the diplomacy and tact in managing men such as possessed, for instance, by Robert Quayle, L. H. Turner or A. W. Wheatley, his record would undoubtedly have been far better, and it is doubtful if the Santa Fe management would have ever allowed him to leave the road. As a matter of fact, possibly a fair share

of his success at Topeka was because the shop superintendent, John Purcell—smiling Johnnie, as some of his friends delight to call him—early in the game appreciated the value of some of Mr. Emerson's ideas and put his shoulder to the wheel in helping to install them in a practical manner. John Purcell is another man who, in a marked degree, understands how to handle men.

* * * * *

To the hard-headed practical shop manager the methods introduced on the Santa Fe in the early stages of the work, which showed concrete practical results, were the improvements made in the care of belts; the improvements in machine tools, shop equipment and handy devices; and the introduction of a shop schedule. Good results were obtained from all of these. The ideas, however, were not original with Mr. Emerson. Fred W. Taylor, the dean of efficiency engineers or scientific management, formulated the rules which were used for the care and maintenance of belting, and Mr. Emerson has freely given him credit. Many of the shop kinks are said to have been copied from those in the Chicago shops of the Chicago & North Western. The idea of the shop schedules was taken from the same place, but was considerably elaborated in introducing it at Topeka. Mr. Emerson must be given credit for a keenness in perception in recognizing these good things. His bonus system was apparently well suited to conditions existing on the Santa Fe at the time of its introduction, but many shop managers who have looked into it carefully feel that it is not so well suited to railway shop conditions in general.

Mr. Emerson must also be given credit for some of the impetus which has been given to the rapid development in motive power department efficiency during recent years. The publicity which was given to his work on the Santa Fe has caused mechanical men throughout the country to consider it carefully, and has undoubtedly stirred many of them to greater efforts and in many ways has been an inspiration to them. It is not hard to trace results of this work on other roads, although it must be admitted that such of Mr. Emerson's principles as appealed to other railways have been applied by them in a most common sense manner with a view to fitting them to suit the local conditions.

* * * * *

The general impression given by the efficiency experts at Washington was misleading. They will probably admit it, but say in defense that the attitude of one of the railway attorneys was so offensive that they were forced to do so. The problem is not merely one of accepting the principles of efficiency as you would buy a machine tool; rather it is to educate and develop men to recognize their value and to correctly apply them. This is not a matter of a day or a year, but of a generation, and can have no effect on the freight rate question, which belongs to the present. Efficiency men will not deny this if approached in the proper manner.

Fred Taylor sounded the call to arms many years ago; and, as with all reformers, took an impractical stand far in advance of his time. Nevertheless, men have recognized the underlying principles of his doctrine, and you would be surprised at the number of railway men who have studied and pondered over them. Not a little of the advance which has been made in recent years in the railway mechanical department may be more or less clearly traced to this, and it is quite probable that the agitation at Washington will stimulate it still more. The possible danger lies in the fact that some road may adopt an efficiency engineer as a universal panacea for all its troubles, with inevitable discouragement and a set back. Working hand in hand, and under the direction of a broad gage man who knows how to handle men, the efficiency engineer may give good results, but the treatment should be taken in homeopathic doses. As one of the efficiency engineers who testified at Washington has since remarked: "The danger lies in the fact that some of the railways may employ so-called efficiency engineers who have been connected with some phases of efficiency work in manufacturing plants, but do not comprehend it thoroughly. They are merely camp followers and are offering their services cheap. As a matter of fact, there is only a small handful of men who have the experience and knowledge requisite to carry this work on successfully."

* * * * *

We believe in the fundamental principles of efficiency, but we know also that their application has been seriously misunderstood by efficiency engineers. We have been fortunate in arranging for a series of articles on the mistakes of efficiency engineers written by one who is thoroughly familiar with the work of both the railways and industrial organizations, and who is capable of discussing the matter in a calm, unprejudiced manner. The first article in this series appears in this issue and refers to the extravagant claims and statements that have been made by efficiency engineers, which have been both unnecessary and unwise.

MECHANICAL ARTICLES DURING DECEMBER.

THE following articles of interest to mechanical department readers, and to which Shop Number readers may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since that of December 2:

Firebox and Tube Failures. Papers presented before the New York Railroad Club by D. R. MacBain and the Western Railway Club by J. W. Kelly, both emphasize the importance of careful investigation and study of firebox and boiler conditions to reduce the cost of maintenance and the number of boiler failures. A great deal of the trouble in severe winter weather is caused by the unequal expansion of the sheets, due to lack of protection from cold blasts while the firebox is being cleaned over the ash pit.—December 9, page 1103.

The Introduction of All-Steel Cars, by W. H. Radcliffe. It is urged that the period of transition from wooden to steel passenger cars be made as brief as possible, because of the fact that the wooden cars act as buffers in a collision, when they are included in a train with steel cars, and suffer severely.—December 9, page 1117.

Facilitating the Flow of Traffic Through Terminals. A correspondent suggests that the M. C. B. defect card be done away with, and that the so-called "protection" inspection as now conducted at interchange points be abolished.—December 16, page 1139.

Quality of Steam and Factor of Evaporation in Locomotive Tests, by J. E. Gardner and L. W. Wilson. A diagram is presented by which it is possible to quickly determine the factors of evaporation as based on 98.5 per cent. dry steam, which is the usual condition encountered in locomotive tests.—December 16, page 1140.

Recent Mallet Articulated Locomotives. Locomotives of this type for the St. Louis & San Francisco and the Chesapeake & Ohio are illustrated and described. Information concerning the service results being obtained on the Chesapeake & Ohio is also included.—December 16, page 1144.

Van Horn-Endsley Spark Arrester. This spark arrester has been thoroughly tested on the locomotive testing plant at Purdue University and in actual service on the Chicago & North Western. The results of these tests, which were made with lignite as well as with bituminous coal, are fully described.—December 23, page 1181.

Balanced Compound Atlantic Type Locomotive for the Santa Fe. These locomotives are illustrated and described. They contain several improvements over the same type of locomotive which has been used with great success in passenger express service on the Santa Fe during the past few years.—December 23, page 1189.

Cars and Locomotives Built in 1910 and Motive Power and Rolling Stock Ordered in 1910.—December 30, pages 1219 and 1257.

NEW BOOKS.

Effect of Key-ways on Strength of Shaft. By Herbert F. Moore. Published by the University of Illinois, Urbana, Ill.

Bulletin No. 42 of the engineering experiment station of the University of Illinois records the results of tests made to determine the relative strength of solid shafts and those with key-ways. The sizes of the shafts tested varied from 1¼ in. to 2¼ in., and for each size the weakening effect of key-ways of different proportions was determined. The shafts were tested in simple torsion and also under combined twisting and bending. The proportions of the key-ways used corresponded with common practice, in which the width is ¼ the diameter of the shaft

and the height of the key ⅛ of that diameter. In nearly all shafts tested the total length of the key-way was about four times the diameter of the shaft. Shafts were also tested with the key-ways for the Woodruff system of keying, but the results do not show any material difference between them and the plain keys. The average efficiency of shafts with the plain key-ways was .85, and that with the Woodruff system .845, efficiency being defined as the elastic strength of the shaft with a key-way divided by the elastic strength of the shaft without a key-way. The test resulted in the determination of an equation for the efficiency of a shaft with a key-way, which is represented as follows:

$$e = 1 - 2\,w - 1.18\,h$$

where e equals the efficiency of the shaft with a key-way, w equals the width of the key-way divided by the diameter of shaft, and h equals the depth of the key-way divided by the diameter of the shaft. It is explained that the equation should not be used for shafts much beyond the sizes of those used in the experiments. A diagram is also given which affords a convenient graphical method of applying the formula. Incidentally, the properties of cold rolled shafting in regard to strength and stiffness were determined, and the average value of the modulus of elasticity in shear (torsion) of cold rolled steel shafting was found to be 11,985,000. The elastic limit in torsion of cold rolled steel shafting was 38,940 lbs. The final results of the tests are given in a table showing the power which can be trnsmitted in torsion by cold rolled shafting at 100 r. p. m. from 1 in. to 2½ in., varying by 1/16 in., with key ways of usual proportions and when the shafting is stressed to the elastic limit. For example, a 1 in. shaft when stressed in torsion to the elastic limit will transmit at 100 r. p. m. 9.5 h. p.; 1½ in. shaft will transmit 32 h. p.; 2 in. shaft will transmit 75.9 h. p.; 2¼ in. shaft will transmit 108.2 h. p., and 2½ in. shaft will transmit 148.3 h. p. In this table no allowance is made for bending action, and as the steel is worked to the elastic limit a suitable factor of safety should be used. Copies of Bulletin No. 42 may be obtained by applying to W. F. M. Goss, director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Proceedings of the American Railway Tool Foremen's Association. 42 pages, 6 in. x 9 in. Secretary, O. T. Harroun, Chicago & Alton, Bloomington, Ill.

The second annual meeting of this association was held in Chicago, July 12-14, 1910. The subjects discussed include the tool room check system; the using, treating, dressing and tempering of high speed steel; the use and care of pneumatic tools, and the tool room—past, present and future. A complete account of the convention was published in the *Railway Age Gazette* of August 5, 1910.

Proceedings of the Traveling Engineers' Association. 392 pages, 6 in. x 9 in. Secretary, W. O. Thompson, master car builder, New York Central & Hudson River, Buffalo, N. Y.

The eighteenth annual convention of this association was held at Niagara Falls, Ont., August 16-19. The papers were well prepared and the discussions were lively. Among the more important subjects considered were fuel economy; superheat; how can the traveling engineer best educate the fireman to become a successful engineer; the latest developments in air brake equipment and their effect on train handling; locomotive lubrication, and new valve gears. An account of this convention appeared in the *Railway Age Gazette* of August 26, 1910.

Proceedings of the International Master Boiler Makers' Association. 194 pages, 6 in. x 9 in. Secretary, H. D. Vought, 95 Liberty street, New York.

The fourth annual convention of this association was held at Niagara Falls, Ont., May 24-27, 1910. The most important subjects considered were the standardizing of pipe flanges for boilers and templets for drilling them; radical departures in boiler and firebox designs; inequality of expansion in locomotive boilers; staying the front portion of the crown sheet on radial stay boilers; steel versus iron tubes; flexible versus rigid staybolts; the best method of applying flues; proposed federal boiler inspection, and the standardizing of blueprints. An account of the convention appeared in the *Railway Age Gazette* of June 3, 1910.

Proceedings of the Master Car and Locomotive Painters' Association. 150 pages, 6 in. x 9 in. Secretary, A. P. Dane, Boston & Maine, Boston, Mass

The forty-first annual convention of this association was held at St. Louis, September 13-16, 1910. Among the more important subjects considered were the use of an oil emulsion as a cleaner; the need of a practical painter in the engine house; the effect of steam on the glue holding veneer; the use and abuse of inert pigments; substitutes for white lead for interior painting; organization of the paint shop force; the effect of repeatedly cutting in with a body color on the burning off period; ideal car paint shop, and the painting and maintenance of canvas roof. An account of the convention appeared in the *Railway Age Gazette* of October 7, 1910.

Proceedings of the International Railway General Foremen's Association. 100 pages, exclusive of advertising; 6 in. x 9 in. Secretary, L. H. Bryan, Two Harbors, Minn.

The sixth annual convention of this association was held at Cincinnati, Ohio, May 3-7, 1910. Among the more important papers presented and discussed at the meeting were those on self-cleaning ash pans; commercial gas as a fuel; advisability of installing hot water washout and filling systems; oxy-acetylene welding; superheaters; location and point of water delivery to the boiler, and an address by Professor Herman Schneider on the work of co-operative schools at Cincinnati. An account of the convention appeared in the *Railway Age Gazette* of May 6, 1910. The program for the next annual convention to be held in Chicago, July 25-27, is more practical and includes such subjects as: How can foreman best promote shop efficiency; shop kinks; methods of shop organization, and the wheel fit on axles.

Letters to the Editor.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.

Bellefontaine, Ohio, January 6, 1911.

I want to take this opportunity to wish every member of the International Railway General Foremen's Association a happy and prosperous year. We have many things to be thankful for in the history of our association, and present indications for our future success cannot be too highly estimated.

Now that the holidays are over and we all feel at our very best, I think it is a good time to ask every member of the association to commence immediately to pull towards our convention in July; when you take hold to pull, see that you have at least a new member in each hand to bring along. I know you are all built of the best material, and for that reason I know you can be depended on to carry out my request. If you want any information, or application blanks, our secretary, L. H. Bryan, of Two Harbors, Minn., will be glad to assist you in every possible manner.

Did you ever stop to think how much you have done for this association? If you haven't done much, now is your opportunity. Have you gained in technical knowledge required by railway general foremen since you have been a member of this organization? If you haven't, I can tell you why! *You have not taken an active part in the association's work!* Now, if you find you have not been as *active* as you might have been, start right away and make up for lost time and show us you mean business. We need your coöperation and activity. Will you let us have it? Of course, you will! I venture to say there is not one member of this association who would decline when called upon to step to the front with the royal banner of the International Railway General Foremen's Association.

I am going to keep in close touch with our secretary to see how many applications you will have sent in by March 1, 1911.

Sincerely and fraternally yours, C. H. VOGES,
President.

Car Repair Kinks.

FIRST PRIZE.

BY W. H. SNYDER.

Assistant General Foreman, New York, Susquehanna & Western, Stroudsburg, Pa.

TORCH FOR HEATING STEEL PARTS.

A crude oil burner for heating damaged parts on steel underframe or all-steel cars is shown in Figs. 1, 2 and 3. The end of the torch (Fig. 3) may be made in any shape or length required for properly directing the flame on the different parts of the underframe of the car. This end is screwed on the short piece of 1¼-in. pipe which fits on the end of that part of the

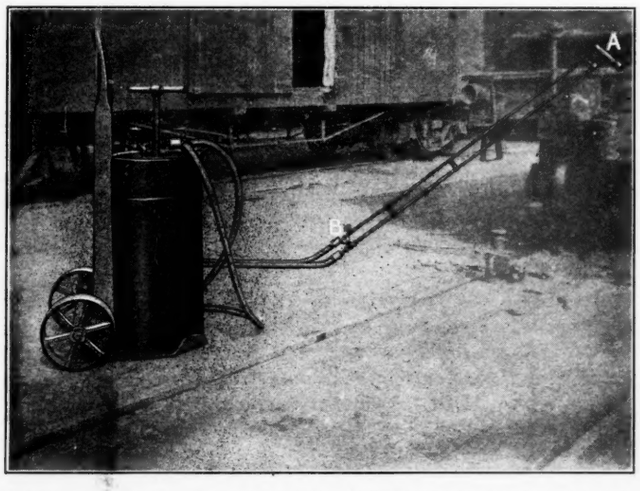


Fig. 1—Crude Oil Torch for Heating Damaged Parts of Steel Underframe or All-Steel Cars.

burner which is shown in detail in Fig. 2. The end shown in the photograph is used for heating two center sills at one time, this operation requiring only a comparatively short amount of time. The burner is regulated by the two globe valves at B, one of which controls the compressed air and the other the oil. The oil reservoir is mounted on a two-wheel truck, so that it may easily be handled about the yards and over the tracks. The hose from the compressed air line is connected just back of the globe valve at the rear of the top of the tank, and air is admitted to the

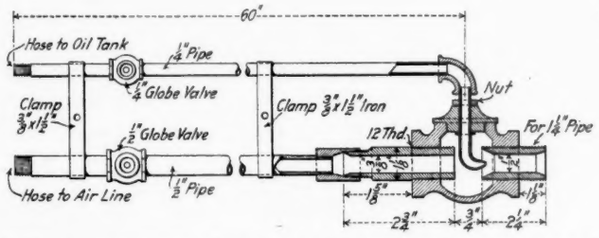


Fig. 2—Arrangement of Air and Oil Pipes and Mixing Chamber for Crude Oil Torch.

top of the tank. This pressure forces the oil out through a pipe, which extends to within 1½ in. of the bottom of the tank, and through the hose to the burner. Air from the top of the tank is forced through the second piece of hose which extends to the burner. The cheapest grade of crude oil is used, cutting the cost down to one-half of what it formerly was with a kerosene burner.

PORTABLE RIVET FURNACE.

The portable furnace for heating rivets shown in Fig. 4 is simple in construction and economical in the use of compressed air. The latter point is quite important, for as a general rule too little attention is paid to the way in which compressed air is used about a shop or a repair yard, and a large amount of it is wasted. A 2-in. pipe, about 10 in. long, with a funnel at its lower end 4 in. in diameter and 4 in. long, is screwed into the

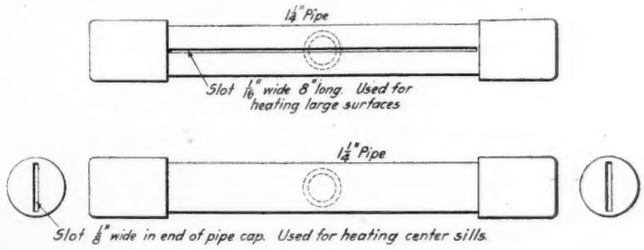

1¼" Pipe
Slot ⅛" wide 8" long. Used for heating large surfaces
1¼" Pipe
Slot ⅜" wide in end of pipe cap. Used for heating center sills.

Fig. 3—Typical End Pieces or Burners for Crude Oil Torch.

bottom of the fire pot. The ⅜-in. air pipe is clamped so that it discharges through a 3/16-in. nozzle in the end of the pipe directly up through the center of the funnel, the top of the pipe being about on a level with the lower part of the funnel. With this arrangement a suction is set up and air from the outside is forced up through the fire. It is possible to heat the rivets as fast as they can be driven in the car, with the air valve opened only one-quarter of a turn. The method of connecting the

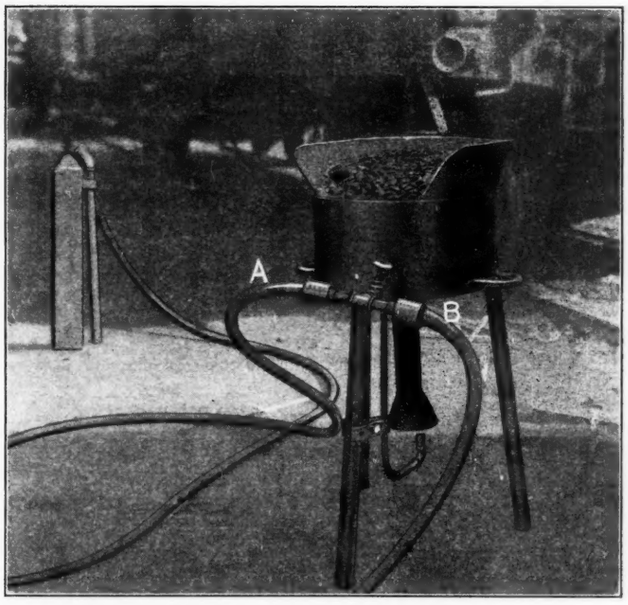


Fig. 4—Portable Furnace for Heating Rivets.

compressed air line to the furnace is also of interest. The hose A, which is connected to the air line, discharges through the end of the T to the hose B, which is connected to the air hammer, while the other connection from the T carries air to the blast pipe. In this way it is possible to operate the forge and the hammer from one air connection, doing away with the use of a second piece of hose.

JACKS FOR STRAIGHTENING STEEL TRUCKS.

The two jacks shown in Fig. 5 are available not only for use in connection with straightening trucks, but also for other work in connection with the repair of the bodies of steel freight cars. The upper one is used for pulling the sides of the steel truck inward when they have been sprung out too far. The

jack is so placed that the two eyes at its ends project through the truck pedestals. Bars are then placed through the eyes and the ends are pulled inward by turning the nut at the center of the jack. The lower jack is used for forcing the

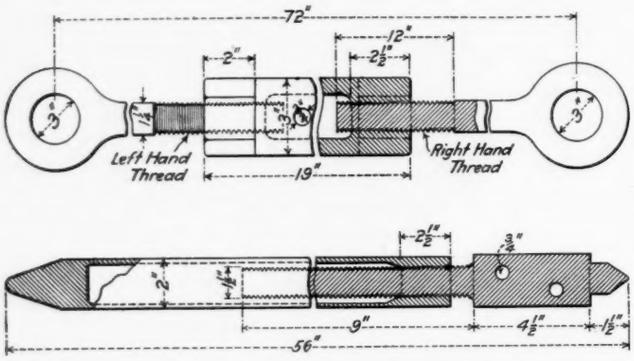


Fig. 5—Jacks for Straightening Steel Trucks and the Bodies of Steel Freight Cars.

sides outward when they have been bent in. The construction and operation are simple, bars for turning the screw being used in the ¾-in. holes in the head at the right hand end.

SECOND PRIZE.

BY C. C. LEECH.
Foreman, Pennsylvania Railroad, Buffalo, N. Y.

TWELVE-TON PORTABLE PNEUMATIC JACK.

A 12-ton portable air jack, with a 20 in. lift, which may be used to advantage in the car repair yard, is shown in Fig. 6. The cylinder is of cast iron, 18 in. in diameter inside. The wheels are mounted on an axle that fits in the wrought iron

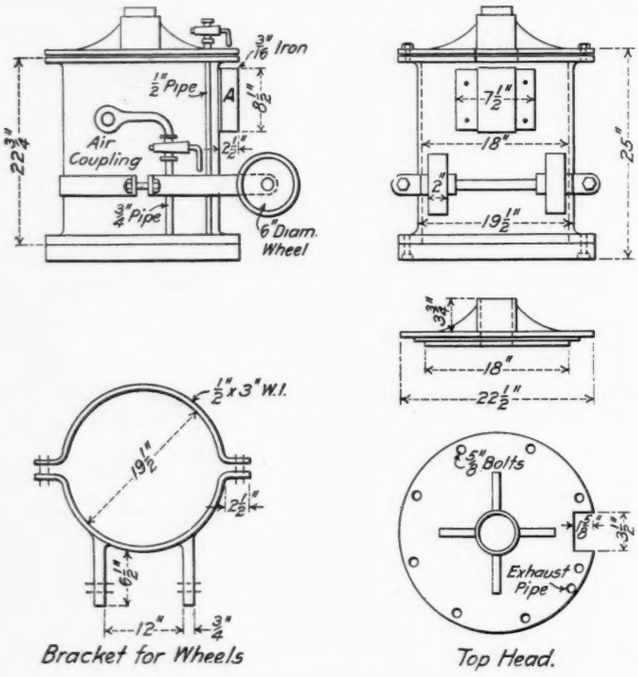


Fig. 6—12-ton Portable Pneumatic Jack.

bracket, which is clamped to the cylinder. A wooden handle, 60 in. long, is flattened at one end to fit loosely into the pocket A, the top flange and cover of the cylinder being cut away to clear the handle. The jack can thus be readily moved about the yard. An air coupling is provided for connecting it to the air line.

CLEANING JOURNAL PACKING.

For cleaning packing which has been removed from journal boxes, a tank has been constructed of heavy galvanized iron, fitted with a steam coil, as shown in Fig. 7. The waste is allowed to remain in this tank 24 hours, at the end of which time most of the oil has been drained to the bottom and through the

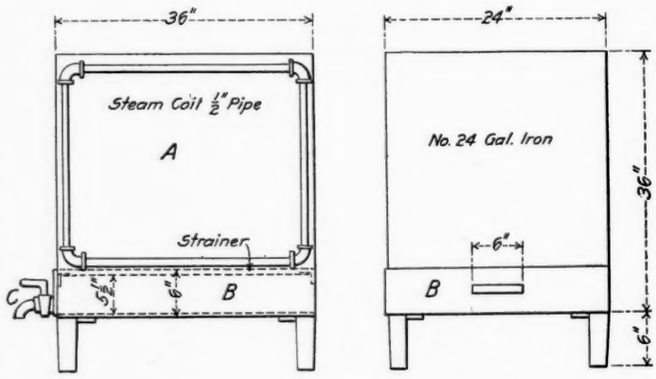


Fig. 7—Tank for Removing the Oil from Old Journal Box Packing.

strainer into the compartment B. The oil as it accumulates may be drawn off through the cock C, after which it may be again strained and prepared for use. The compartment B is so arranged that it may be removed occasionally for cleaning. When the waste is removed from the tank it is placed on the cleaning table shown in Fig. 8 and is thoroughly shaken and cleaned.

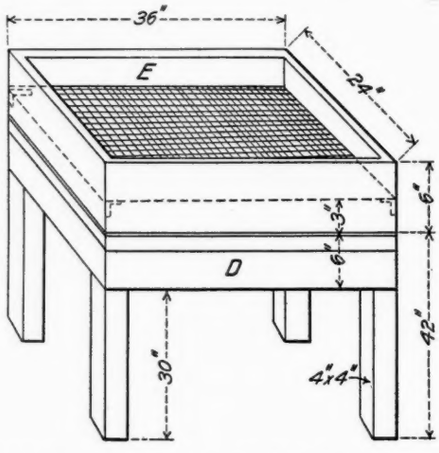


Fig. 8—Table for Cleaning Journal Box Packing From Which the Oil Has Been Removed.

the dirt and dust passing through the screen, which has openings ½ in. square. After this treatment the waste is saturated with fresh oil by the method described below.

PREPARATION OF JOURNAL BOX PACKING.

For preparing packing for use in journal boxes, three tanks are provided, as shown in Fig. 9. In each of the two larger tanks, A and B, are placed 80 lbs. of waste and 560 lbs. of oil. After the waste has had sufficient time to become thoroughly saturated, 240 lbs. of oil are drained off, leaving 320 lbs. of oil to 80 lbs. of waste, or 4 lbs. of oil to each pound of waste. The third tank C is smaller than the other two, and is used for the preparation of old waste which has been reclaimed, as described above.

RECLAIMING JOURNAL BEARINGS.

Many repair yards follow the practice of putting new bearings in journal boxes when a pair of wheels is changed. Very often the old bearings are only slightly worn and are good for considerably more service. Ordinarily the journals from which

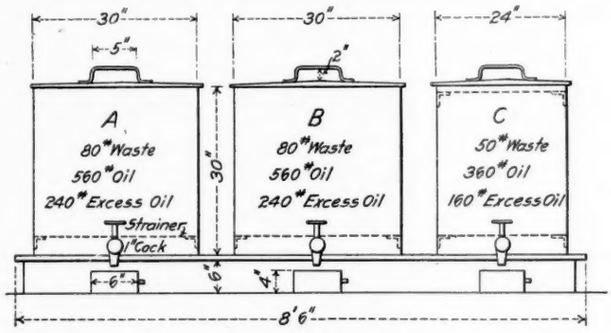


Fig. 9—Tanks for Preparing Journal Box Packing.

they are removed are worn smaller than the standard and the bearing, when placed on another journal, will not fit down on the crown. In order to use the bearings again it is necessary to refit them to the journal so that they will have a proper bearing. The device shown in Fig. 10 has a number of rollers of different

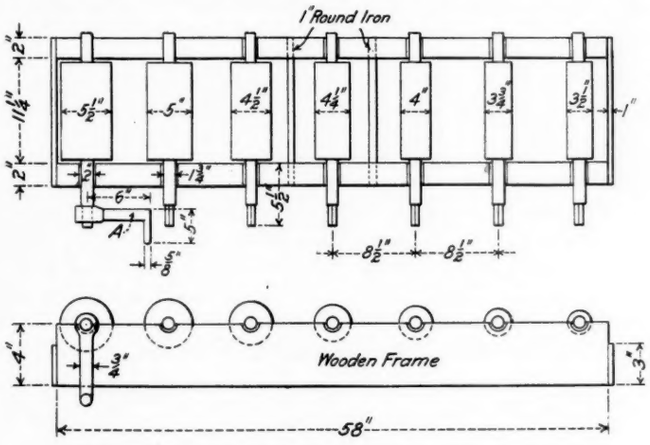


Fig. 10—Rollers Used in Refitting Journal Brasses.

diameters. The operator covers one of these, which corresponds to the diameter of the journal for which he wishes to use the brass, with black lead, after which he places the bearing on the roller and turns it by means of the handle A. The bearing is then removed to a convenient bench fitted with a clamp so it may be held rigidly while it is being scraped.

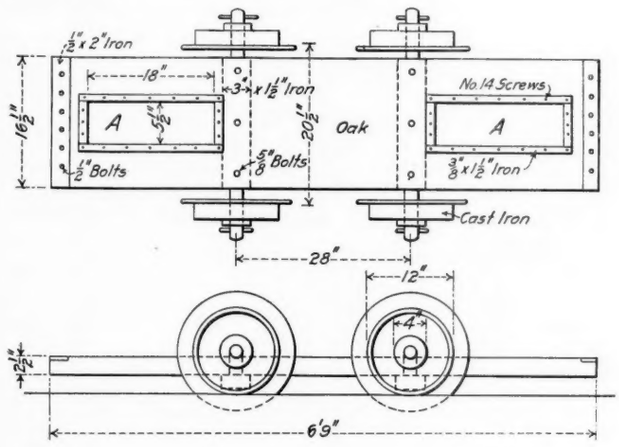


Fig. 11—Truck for Transporting Mounted Wheels.

TRUCK FOR HANDLING MOUNTED WHEELS.

In most car repair yards narrow gage lorry tracks are provided between every other pair of repair tracks for the transportation of supplies and material. One of these tracks at our shop starts near the wheel storage tracks. The truck shown in

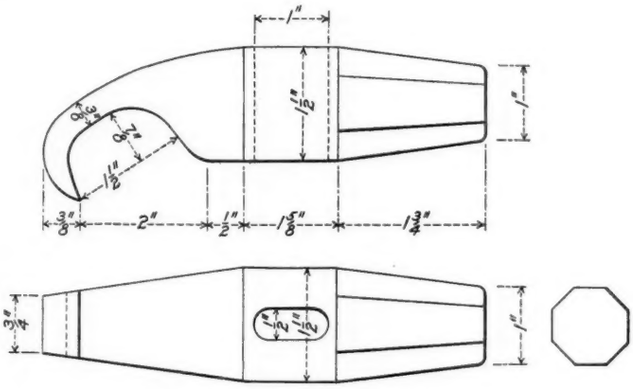


Fig. 12—Car Inspector's Hammer.

Fig. 11 may be placed on the narrow gage track and a pair of wheels rolled on it; the wheels drop in the cavities A, which are 5½ in. wide, and are thus held from rolling off while the truck is being moved about the yard. Mounted wheels, which are removed from the cars, may be transported about the yard in the same way.

CAR INSPECTOR'S HAMMER.

A convenient form of car inspector's hammer, made of low-grade steel, with a hooked end for lifting journal box slides, uncoupling steam hose, and useful for a variety of purposes, is shown in Fig. 12.

COMBINATION BAR AND NAIL PULLER.

The combination steel bar and nail puller shown in Fig. 13 is

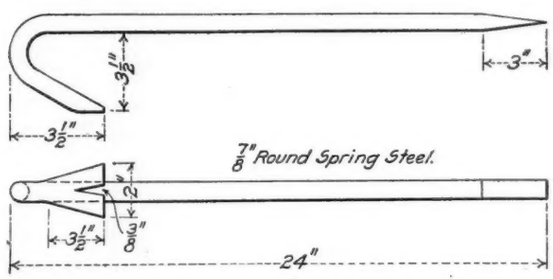


Fig. 13—Combination Steel Bar and Nail Puller.

a most convenient tool for use in a car repair yard; it may also be used in connection with the removal of small bolts.

WRENCH FOR OPERATING HOPPER DOORS.

The wrench shown in Fig. 14 is convenient for operating the winding bar for closing the hoppers on freight cars. The square ends on the winding shafts vary in size on the different classes of equipment, and such a wrench is necessary unless a number

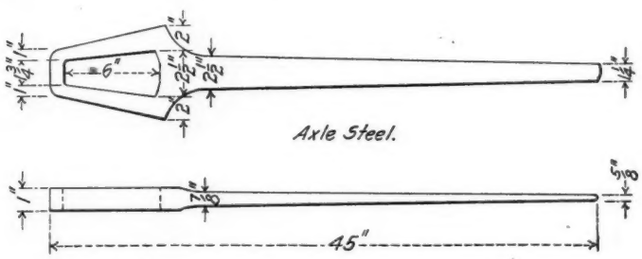


Fig. 14—Wrench for Operating Hopper Doors.

of different size wrenches are available at different points throughout the yard.

PORTABLE YARD DERRICK.

A handy yard derrick, operated by air and used in handling heavy material in the repair yard and for unloading lumber, is shown in Fig. 15. Details of the air cylinder and boom are

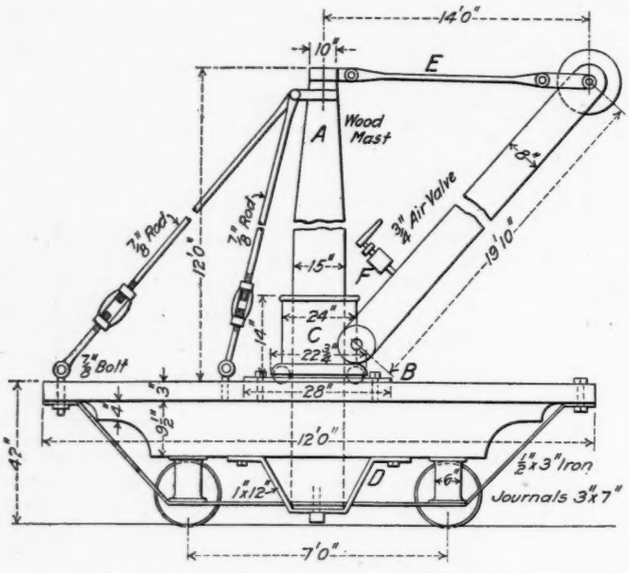


Fig. 15—Portable Air Operated Derrick.

shown in Fig. 16. Our derrick is used on 6 ft. gage track, but a similar car could be used equally well on standard gage, especially if outriggers or clamps were used when very heavy loads were handled. The car is of heavy wooden construction, well braced, and the mast is of oak, braced by a heavy bracket. The casting C, to which the boom is fastened, swings freely around the mast, operating on cast iron balls which fit in a groove or runway. A rope is fastened to the top of the boom for swinging it from side to side. The collar at the top of the mast, to which the tie rod E is attached, is arranged to revolve easily about the mast. The air cylinder is constructed of wrought iron pipe and is arranged so that air may be admitted at either end by means of the 3-way valve F. The stroke of 7 ft. is doubled by weaving the chain around the sheave which is fastened to the end of the piston rod. As may be seen, the end of the piston rod is fitted with a crosshead which runs in guides, thus preventing the rod from being bent or distorted.

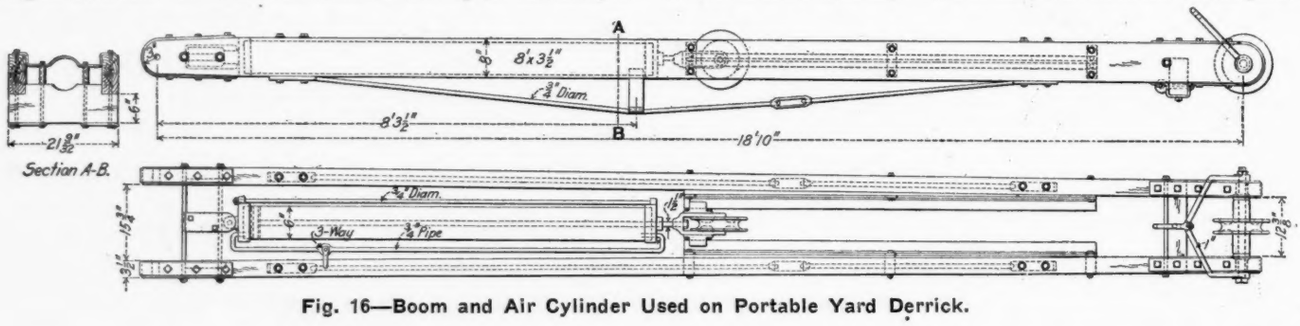


Fig. 16—Boom and Air Cylinder Used on Portable Yard Derrick.

BY F. RATTEK,

BRIGHTON, MASS.

REPAIRING BATTERED THREADS ON BOLTS.

To the car repairman the two-piece die and die holder, shown in Fig. 17, are worth their weight in gold for running over old bolts that have become rusted or have battered ends. Instead of starting at the end of the bolt, as is done with the standard die, the two pieces are placed over the threaded portion, the holder is slipped over them and the die is screwed off the bolt.

EMERGENCY JOURNAL BEARING.

The journal brass shown in Fig. 18 may often be used to splendid advantage for curing or overcoming a hot box without replacing the axle, provided the journal is not too far gone. The

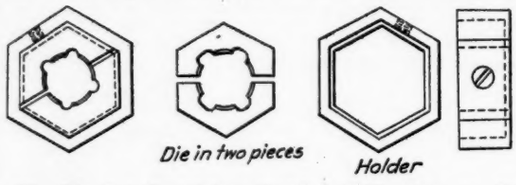


Fig. 17—Die for Repairing Mutilated Threads on Bolts.

repairman must, of course, use good judgment. Instead of holding the car and removing the wheels, it is often possible to save the journals for several thousand miles additional service by applying the brass shown. It has a babbitt lining, which is cast on

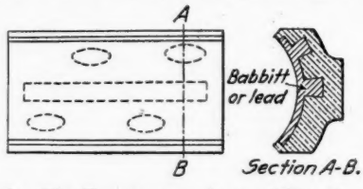


Fig. 18—Emergency Journal Bearing.

an arbor the same diameter as the journal on which it is to be used. It must not be bored, filed or fitted, and must not be used on newly turned journals.

BY THEODORE ROWE.

Foreman, Great Northern, Jackson Street Shops, St. Paul, Minn.

TURNING STEEL-TIRED CAR WHEELS.

Some time ago we installed a 42-in. Putnam coach wheel lathe in the Jackson street shops. Great things were expected of it, for the makers claimed a record of something like 22 pairs of wheels in a 10-hour day. We managed to turn out seven pairs a day, and sometimes eight, although this appeared to be the limit, owing to the fact that too much time was required for pulling the tailstock back and running it forward again after the wheels had been put in place. Often as much as 10 or 15 minutes was required for doing this. To remedy this difficulty we removed the hand rigging for doing this work and fitted up an air cylinder, as shown in Fig. 19. With this arrangement it was possible to make the change in from two to two and a half minutes, thus allowing an output of from 12 to 13 pairs of wheels in nine hours. As may be seen, the air cylinder is mounted on a hardwood block, which is placed directly back of the base of the machine and is connected to it by the 3/4-in. steel plate. By means of the three-way cock, air may be admitted to either end of the cylinder, enabling it to operate in both directions. We also made and applied a 48-in. scale on the side of the tailstock and in a location convenient to the operator. The scale is graduated in 1/16-in. for a distance of 24 in., so that the operator can

readily set his calipers accurately. These appliances, from a practical standpoint, help greatly to make the machine up-to-date and modern.

CRANE FOR HANDLING STORAGE BATTERIES.

The storage batteries used in connection with the electric lighting of passenger equipment have to be handled frequently

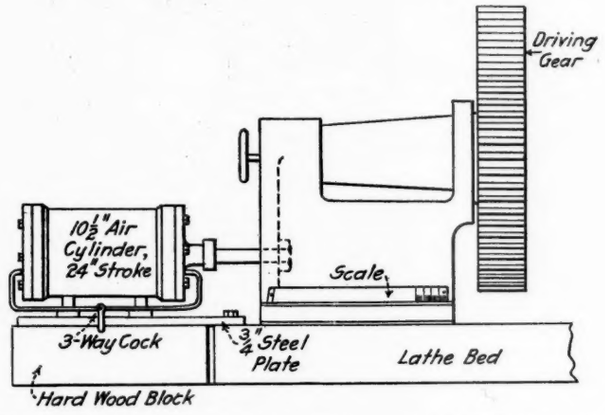


Fig. 19—Application of Power Traverse to Tailstock of Car Wheel Lathe.

in connection with flushing them with water. These boxes weigh about four or five hundred pounds apiece when filled, and it is necessary to lift them about 3 ft. from the floor. Several workmen have been hurt in doing this by having fingers pinched or hands crushed. To overcome the difficulty in handling the boxes, a jib crane and an air hoist were constructed, as shown in Fig. 20. With this crane it is possible for one man to safely

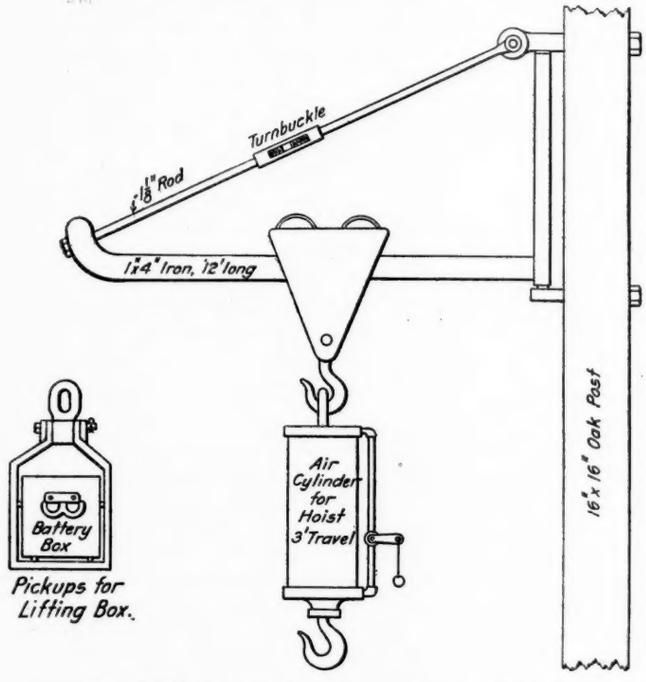


Fig. 20—Crane for Handling Storage Batteries.

lift and clean a set of batteries in a comparatively short time; formerly three or four men were required for this work. With an air pressure of 90 or 100 lbs., the capacity of the crane is about two tons. This type of crane can also be used to advantage for serving lathes, planers or other machines which handle heavy work in the machine shop. As may seen from the drawing, its construction is simple.

JACKING UP COACHES.

Modern passenger car equipment has grown so heavy that something better than a hand or ratchet jack is required for lifting the cars in order to remove or replace the trucks. We have constructed four 17-in. air jacks (Fig. 21), one of which is placed under each corner of the car. The two jacks at each end are connected with the same air line and are operated by the same valve, so that the end of the car is raised evenly. These

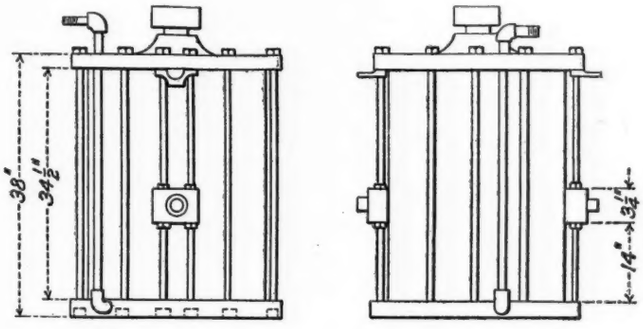


Fig. 21—17-Inch Air Jack for Lifting Coaches.

jacks have been in service for eight months and have not required any repairs, and it looks now as if they would operate indefinitely without requiring any. The use of these jacks has greatly reduced the amount of time required for removing and replacing the trucks when it is necessary to change the wheels. The cylinders of the jacks are constructed of ½-in. boiler steel, which is rolled to the proper size for boring and is welded instead of being riveted. A two-wheel buggy has been constructed which carries the jacks in such a way that the load is evenly balanced and they can be conveniently moved from place to place about the yard or through the shop. The handle

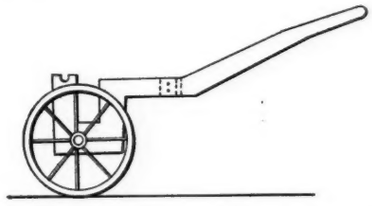


Fig. 22—Buggy for Transporting Air Jacks.

of the buggy (Fig. 22) is raised and the uprights, which have U's at the top, are pushed under the two lugs on the jack. By lowering the handle the jack is raised off the ground and may be pushed about the yard.

BY A. G. PANCOST.

Draftsman, Elkhart, Ind.

PREPARING WASTE.

Cotton or woolen waste, in order to give the best service for use in journal boxes of freight or passenger cars, should be thoroughly soaked in oil, after which the surplus oil should be allowed to drain off. Waste prepared in this way can be packed more firmly about the journal and will give much more satisfactory results than if it is placed in the box too wet. A box, or tank, for preparing the waste is shown in Fig. 23. The inside is lined with heavy galvanized iron, and two cleats are placed on the inside of the box about 8 in. from the top, as shown. These support a tray, which has for its bottom a 1/16-in. mesh wire netting. The tray is only about one-half the length of the box, and may be shifted from one end to the other. The lower part of the box is filled with oil and waste. After the waste has become thoroughly saturated, it is transferred to the

tray, and the surplus oil is allowed to drain off. It is removed from the tray in dope buckets as it is needed.

CAR REPAIRMAN'S SIGNAL.

Repairmen who are working on cars standing on tracks which lead to other parts of the yard should be protected by a con-

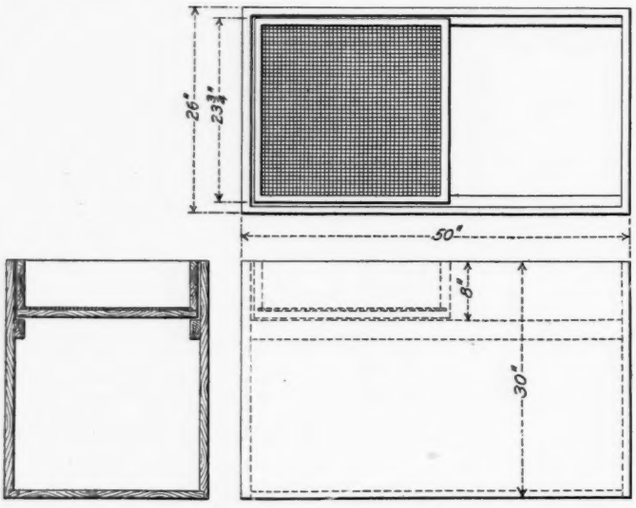


Fig. 23—Tank for Preparing Journal Box Packing.

spicuous and substantial signal in order to caution trainmen against entering the repair track either with other cars or with a switching locomotive. The ordinary flag is unsatisfactory, as it soon becomes soiled and may easily be lost, torn or blown away by the wind. To overcome this, the signal shown in Fig.

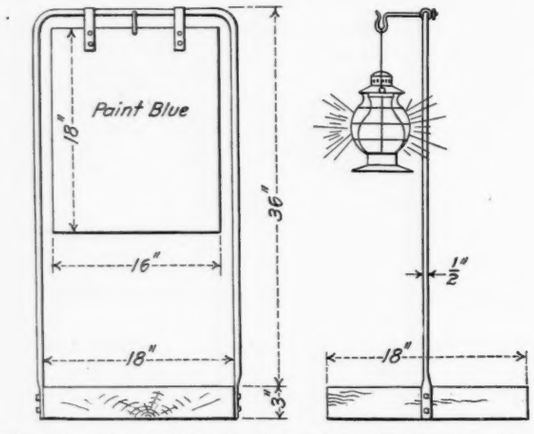


Fig. 24—Substantial Signal for Use of Car Repairmen.

24 has been constructed. The block which forms the base is heavy and insures the signal remaining in an upright position. One of these signals is left near each end of all entrance tracks to the repair yard and is always at hand when required. When in use it is placed in the center of the track. The banner should be painted occasionally, but this is the only attention which it will require.

STORAGE OF REPAIR MATERIAL IN THE YARDS.

Car inspectors in charge of the work in a large yard must be prepared at any moment to shoulder their tools and look over a train that is either entering the yard or preparing to leave it. The inspector does not, of course, know just what material he will need for repairs, and if he did he would probably be unable to carry it for any distance. It is therefore desirable to provide some arrangement for storing a limited supply of the parts which are most often required convenient to the places where repairs may have to be made. This is particularly true in the case of such articles as air hose, knuckle locks, pins, cotters, bolts, etc. A box, similar to the one shown in Fig. 25, may be used to good advantage for storing such material. These boxes are placed on two ties partly sunk in the ground, and are located from 150 to 250 ft. apart on the side of the yard that is most convenient to the workmen and about 8 ft. from the track. In addition to these small boxes, others, about three times as large, are placed from 500 to 600 ft. apart alongside of the yard

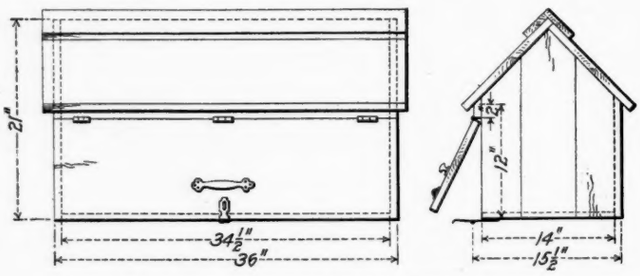


Fig. 25—Box for Storage of Car Repair Material.

and are used for the storage of oil, waste and heavy tools. These centers for supplies may also be used as dumping places for scrap material which is gathered up about the yard and is picked up by a work train at regular intervals. This method of storing material in a convenient place for the repairmen not only enables them to do more and better work, but prevents the material from being scattered promiscuously through the yard and being lost or destroyed by exposure to the weather.

RACK FOR STORING COUPLER KNUCKLES.

In car repair yards where a large amount of work is done, including foreign cars, it is necessary to carry quite a large amount and variety of coupler knuckles. As many of these knuckles do not differ greatly in construction, it is advisable to keep the different types piled separately and have them properly labeled, so that no time will be lost in finding the proper one.

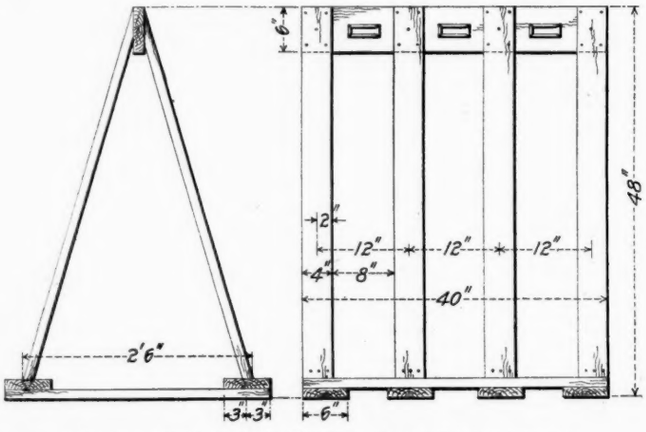


Fig. 26—Rack for the Storage of Coupler Knuckles.

Because of their shape, it is difficult to arrange them to advantage without some means of support. The rack shown in Fig. 26 has been devised for this purpose. A piece of tin, bent so that it will hold a card, is tacked above the top of each space and contains the name of the knuckle stored below. Besides adding to the neat appearance of the yard, the stock of knuckles can readily be accurately checked at any time without unnecessary handling.

POLISHING JOURNALS.

It is often necessary to re-turn the journals on car axles and after turning them they should be polished with emery. Fig. 27 shows a simple but efficient device for doing this. The two wooden pieces are of well-seasoned oak or hickory. The opera-

tor places these blocks about the journal, as shown, and drops the leg which is hinged to the lower block. Two sheets of fine, well-oiled emery cloth are inserted between the blocks and the

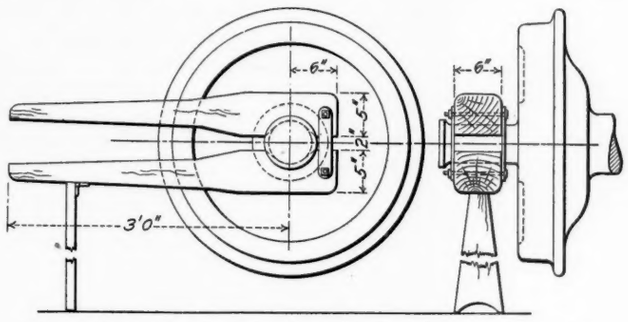


Fig. 27—Device for Polishing Newly Turned Journals.

journal; the lathe is started up and the operator places his weight on the outer end of the top block. In a short time a smooth, polished surface is obtained.

INSPECTORS' EMERGENCY REPAIR CART.

At terminals where all trains change engines and crews, and the inspectors are allowed only from two to ten minutes to thoroughly inspect the train, speed and accuracy are required on the part of all concerned in order that the train may leave the

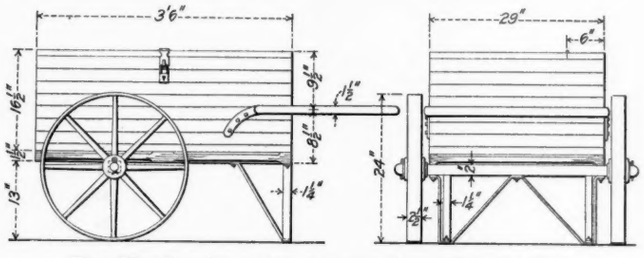


Fig. 28—Car Inspectors' Emergency Repair Cart.

terminal on time and in safe condition. It is necessary to have any tools or repair material that may be needed close at hand. A cart, which contains an emergency equipment, used for making speedy repairs to hot boxes, is shown in Fig. 28. This is always kept near the station and contains dope cans, waste, oil, special packing tools, jacks, blocking, extra journal brasses, etc. The use of this emergency cart has made possible the prompt handling of repairs to hot boxes.

APPRENTICE OR CONTINUATION SCHOOL OF CINCINNATI.

F. B. Dyer, superintendent of the Cincinnati schools, in an address before the National Society for the Promotion of Industrial Education, Boston, Mass., November 18, spoke at length on the work of the continuation school which was established in Cincinnati in 1909. He said: "This school is not a trade school, but is designed for the intellectual improvement of those boys who are already apprentices. It catches the boy in the shop and brings him to the school. The attempt was made to get apprentices to attend the night schools, but with little success. The apprentice is a daytime proposition. He has not the physicial endurance to work all day and go to school at night. The period of apprenticeship is a critical one, as the boy at this age needs guidance and right ideals kept steadily before him. He needs to have an intellectual interest created in his work in order that he may be ambitious to become, instead of a mere hand, the master of an honorable craft. The board of education provides the school and the teachers; the manufacturers release the boys one-half day a week and pay them, if they attend the school, their regular wages; if they do not attend, they are docked. About 250 machine shop apprentices are enrolled. The school runs 48 weeks a year, 8 hours a day. The teachers are allowed two half days to visit the boys in their shops, consult with the foremen and gather material for the school work. The boys are graded according to their intellectual ability—the immature coming the first part of the week and the mature the last part.

"The course of study consists of an hour of blue print reading and free hand drawing, an hour of shop science, an hour of applied mathematics and a general hour for cultural purposes, including civics, industrial geography and history, reading, etc. The method is distinctly practical and objective. While the mathematics is arranged so that topics follow a proper sequence, the mathematical principles are applied directly to the machines in use in the shops, and all non-essentials are eliminated. The school operates at night for adult workers, and on Friday night the foremen meet and discuss phases of their work. This school has been in operation a year and a half. The attitude of the boys toward the work and their employers is wholly changed. The foremen state that the output of the boys has increased rather than diminished, as the added interest and intelligence more than compensate for the loss of time. The expense of operating the school is about $3,000, or $15 a student per year. The board of education has so much faith in the idea that it has secured the proper legislation to permit the establishing of continuation schools for youth who go to work, until they are sixteen years of age, with power to compel attendance 8 hours a week in day time. The board has set aside $15,000 for this purpose in the year 1911. The next school to be opened is for sales girls who are over sixteen years of age. Certain firms have agreed to send at least 200 under the same conditions as the boys who now go. The compulsory continuation schools will be opened upon a large scale early in 1911."

A NEW THEORY OF BELT DRIVING.

Under the above title Selby Haar, of the General Electric Company, at Schenectady, N. Y., presented a paper at the recent meeting of the American Society of Mechanical Engineers in New York. It consisted largely of experimental data from German sources and particularly the results of experiments by Professor Kammerer and C. Otto Gehrckens. Prof. Kammerer's conclusions are as follows:

a The effective pull on a belt is not reduced so much by centrifugal force as the currently accepted method of calculation would lead one to expect. In other words, the maximum allowable tension in a belt apparently increases with the speed.

b The coefficient of friction increases with the speed and reaches values far above that usually assumed.

c The maximum efficiency of transmission is not limited by the speed.

d The coefficient of friction is larger for large pulleys than for smaller ones.

e A wooden pulley has a higher coefficient of friction than an iron one, at least when new.

f Transmission is more efficient, and the coefficient is higher when the smaller pulley drives.

g A belt operates with higher efficiency and usually with less creep when the tight side is on the bottom.

h A properly placed idler improves the efficiency of transmission.

i The neutral layer is symmetrically located in the belt so that the effective diameter is the sum of the pulley diameter and the thickness of the belt.

j At any speed the sum of initial tension and centrifugal force is constant.

In closing the paper Mr. Haar said: "It appears proved that the maximum allowable tension in a belt is not constant and neither is the belt velocity, even though the pulleys revolve at constant speed. The efficiency of a belt is shown to be quite high, just as high as a good gear transmission, the overall effi-

ciency of the belt transmission being considerably reduced by larger bearing friction losses. This shows that the improvements should come in the bearings, as by the use of ball or roller bearings, for example. The exceptional flexibility of a belt transmission has made it a favorite for many difficult problems. We shall close with the following remarkable—and, we are afraid, over-enthusiastic—prophecy of Mr. Gehrckens: '11,900 ft. per min. is no limit to belt speeds at present. Belt pulleys have run at 98,000 ft. per min. Brown, Boveri & Co. have reached 74,000 ft. per min.; the Schuckert Company run flywheels at 19,600 ft. per min., and so do American manufacturers. Air resistance is an important feature at such speeds. When air is excluded the resistance decreases to one-half, and in a vacuum it is almost nothing...*..*..*..We are by no means close to the limit of belt speeds, and the capacity of the belt does not commence to increase until high speeds are reached. Steam turbine speeds are so high that some reducing device must be provided and for this purpose the belt is the simplest and most practical connecting link. With transmissions at such high speeds the construction must be painstaking and the crowning of the pulley is an important feature.'"

A number of members discussed the paper, all of them disagreeing with the author as to the advisability of using extremely high speeds. The general opinion seemed to be that it was much better to run belting under 5,000 feet per minute in all cases except for main drives, and that in many cases there was greater economy in not exceeding 4,000 feet per minute, even at the loss of belt efficiency, owing to the fewer delays than where belts were strained too tight and run too fast.

MAKING PILOT RIBS.

BY S. S. SEE.

Foreman of Planing Mill, Norfolk & Western, Roanoke, Va.

Not only is the bevel different on each end of a pilot rib, but each rib differs from the one next to it, no two being alike except the corresponding ribs on each side of the center rib. The device used for cutting these ribs, as shown in the accompanying illustrations, is simple in construction and is easier and quicker

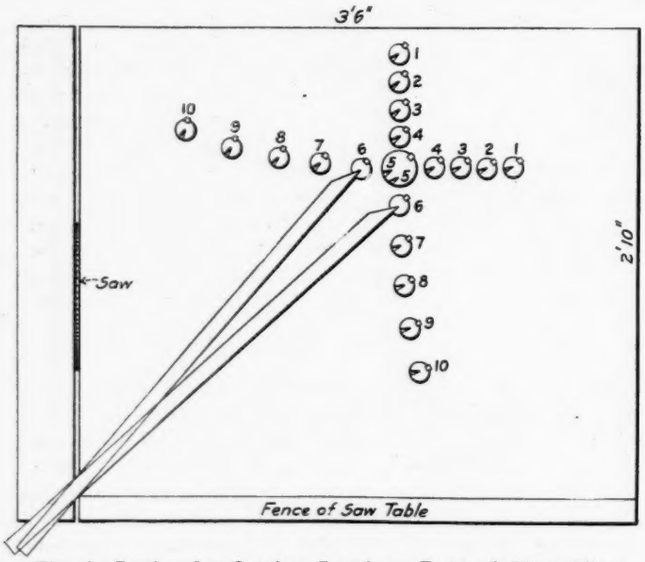


Fig. 1—Device for Cutting Bevel on Ends of Pilot Ribs.

to operate and more accurate than the usual method of laying out each rib with a templet. It does not require a skilled mechanic to operate it and may be used with any type of cut-off saw. The device is made of hard wood, securely braced so that it will not warp, and of about the dimensions shown on Fig. 1. It is securely bolted to the saw table to prevent it from moving out of line when in use. Each of the stops, which are numbered from 1 to 10, in two rows, represents a different bevel. These stops are 1½ in. in diameter and have small keys glued to them to keep them from turning. When not in use they are pushed down so that the tops are level with the top of the board. When in use they project above the board ½ in. and are held in place by the button or small piece on the underside of the board, which

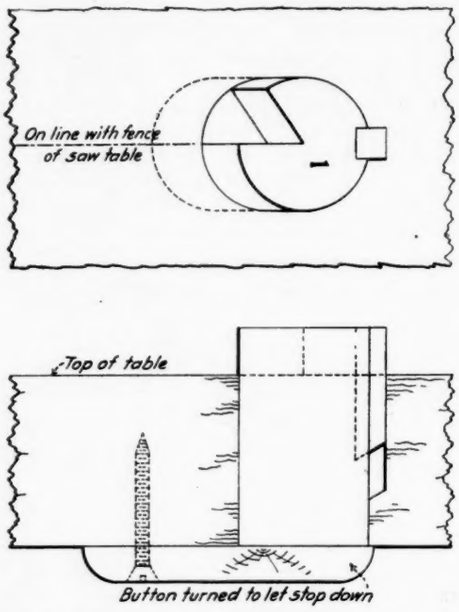


Fig. 2—Detail of Stop Used for Cutting Bevel on Ends of Pilot Ribs.

swings about the screw, as shown in Fig. 2. The material to be cut is first prepared by dressing it to the proper size. To show how the board is used, assume that the long rib is to be cut. The material is placed on the device with one edge resting against the end of the fence on the saw table and one end projecting over stop No. 1, similar to the first position shown in Fig. 3, with the edge lined up with the side of the notch, as shown. The other end is then cut off and the bevel thus formed is placed in

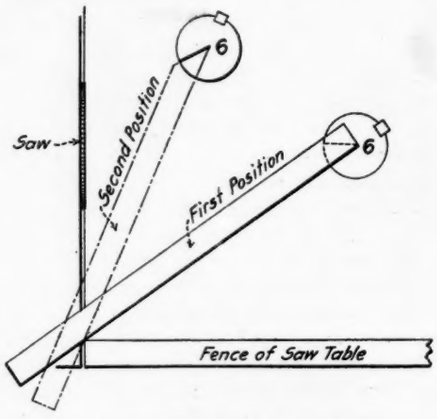


Fig. 3—Showing How the Ends of the Pilot Rib are Cut to the Proper Bevel.

the notch of the corresponding stop No. 1. The proper bevel is then cut on the other end of the rib. In this condition the rib would be a little too long, a point projecting above the top of the bumper beam. By means of a special stop this point is cut off at right angles to the beveled edge at the top of the rib, and it is then ready for use.

THE MISTAKES OF THE EFFICIENCY MEN.

BY ONE WHO HAS WORKED WITH THEM.

I

EXTRAVAGANT STATEMENTS AND CLAIMS.

From the reports in the daily press, as well as in some of the technical journals, it would appear that railway managers are opposed to what are termed "efficiency methods." The battle seems to be on between them and the efficiency men. It is unfortunately true that in certain quarters a real gulf exists between those who are preaching the gospel of efficiency and those who are working out in a practical way the problems which confront them in railway operation. It is but natural to expect that railway managers, who have spent years in efforts to raise the standard of railway service and to operate at the lowest ratio consistent with safety and efficiency, should view with distrust the claims that efficiency men make, after what, to a veteran, is but a cursory investigation of condtions. It is even doubtful if in many cases any investigation whatever has been made beyond a comparison of actual costs of units of output or service with certain assumed ideals.

There can be no logical discussion of any question without an agreement upon the points to be discussed. The difference between the railway man and the efficiency engineer is often due to the point of view. There is no initial meeting of the minds. Prejudice may exist on both sides but the blame can generally be laid at the door of the efficiency men. The principle of efficiency, which has always existed, is being stabbed in the house of its friends. And more than to anything else, efficiency men can lay the blame for their failure effectively to impress the average railway manager to their proneness to extravagant claims and carelessly arrived at conclusions. Discount their assertions 50 per cent. and most railway men will agree with them.

Extravagant claims are of two kinds: *First,* misrepresentation, either wilful or through ignorance, and, *second,* extravagant in the sense that, even though possible of proof, their mere assertion creates a prejudice against them and thus prevents a fair trial of proof. And of the two, the second is the more insidious. A claim based upon misrepresentation or ignorance is proved to be untrue when the facts are known; and the discovery of the facts is in itself a most important step in an investigation into high costs or low efficiency. But a claim that, because of its extravagance, immediately calls for a flat denial, even though having foundation in fact, is usually thrown out without a hearing. To such claims on the part of efficiency men is due the apparent absence of agreement between them and those whom they would enlighten. The astonishing thing is that the efficiency men continue to make the same fatal mistake; and it is unjustifiable because it is so unnecessary. Examples of failure of efficiency schemes are legion.

An efficiency expert in the employ of a large concern had not been long on the job when he informed the manager in no uncertain terms what could be saved and how it could be done. There was no doubt either as to the amount or the method. As action did not immediately follow, the efficiency man telegraphed the manager of the company urging him not to delay because every hour's delay meant an actual loss of one hundred dollars. Perhaps there was a leak somewhere in the plant; the management may not have been all that it should; and it is not unlikely that the amount named might have been saved through efficiency methods. But why was it necessary to invite criticism by making the bold claim and thus create a prejudice at a time when cooperation was the one important thing?

Another efficiency engineer, after making a study of a manufacturing plant, reported that by the purchase of four more of a certain machine tool (doubling the number of that type of tool then in use) the output of the plant could be doubled without the necessity for spending another dollar. This claim startled the president and his chief engineer (perhaps it amused them), especially in view of the fact that plans had been made and materials ordered for a general extension of the plant for the sole purpose of increasing the output. If by purchasing four machines at an approximate cost of $16,000, the output could be doubled, it were criminal to erect additional buildings at great expense. Credit should be given the management for investigating the basis of such an apparently extravagant claim. It was found that the efficiency engineer meant that, as among all the machine tools in the plant, only these four were being run double shift in order to keep the balance of the equipment running but one shift; four additional machines also running double shift would make it possible to run the entire plant day and night and thus increase the output two-fold. It is hardly necessary to add that the original plan to enlarge the plant was not abandoned.

A third extravagant claim is that used to illustrate the alleged enormous waste in railway operation. It has done yeoman service on various occasions. It runs something like this: A locomotive in first-class condition is but 50 per cent. efficient if the track and roadbed have been allowed to deteriorate 50 per cent. If, in addition, the engineman has an efficiency of but 50 per cent., the result is to reduce the efficiency of the locomotive to 25 per cent. If, further, the fuel used has but half the heat units it should have, the combination of poor track, engineer and fuel results in an efficiency of but 12½ per cent., or a waste, or inefficiency, of 87½ per cent. The argument appears logical enough, but however compelling it may be to the layman, the railway manager knows that such conditions do not exist. Except in extreme cases no roadbed is allowed to deteriorate to such an extent as to carry but half the traffic it should. There cannot be such a combination of poor roadbed, locomotives and cars, men, fuel, etc., for the reason that long before these factors are allowed to deteriorate sufficiently to affect the net results materially, the remedy is discovered and applied. Locomotives are taken out of service and shopped before their condition has any appreciably damaging effect upon traffic. Engineers who are unable to meet their schedules must promptly give way to those who can.

It must be admitted that not unusually there is a basis in fact for many of the extravagant assertions of the efficiency men. It is because this is true that their claims not only do not accomplish what they are intended to, but, on the contrary, have the effect of obscuring actual conditions. That machine tools in most manufacturing and railway shops are not operated as efficiently as they should be, that the cost of maintenance is high, that the efficiency of the average workman is low, that fuel and supplies are being wasted, that locomotives and cars are not always repaired economically, is unquestionably true. And it is important that the truth in this respect should be told. The plain truth, however, is sufficient; and although it requires frequent repetition, it needs no embellishment. It is an encouraging sign that, although not bearing the insignia of the efficiency men, there is an ever increasing number of those who not only recognize the principles that underlie efficiency methods, but who are successfully applying them. This is the leaven that shall leaven the lump.

The Bolivian Antofagasta Railway is building at an approximate cost of $4,520,000 gold a line of railway from Rio Mulatos on the Antofagasta (Chile) and Bolivia Railway—to Potosi. The track is leveled on about 8 miles from Rio Mulatos. Thus, in less than two years' time, Potosi, the center of the largest tin-bearing area in Bolivia, will have an easy outlet for the transport of its minerals by rail down to the port of Antofagasta. The Antofagasta line will be constructed up via Oruro to La Paz, and ultimately from thence to the port of Tacna, on the Pacific coast. The import trade of Potosi will be facilitated by the same means, and it is confidently expected that by the reduction in freights and the influx of laborers, the new line will enable lower grade tin and copper ores, the quantity of which is incalculable, to be worked from Potosi to Rio Mulatos.

Increasing Shop Output.

FIRST PRIZE.

HOW THE OUTPUT OF A LOCOMOTIVE REPAIR SHOP WAS INCREASED.

BY H. L. BURRHUS.

Assistant to General Foreman, Erie, Susquehanna, Pa.

Importance of Knowing Costs.—The successful foreman is the one who can give actual figures on the cost of labor and material for every job done in his department. With this knowledge he can instantly tell whether it is being run successfully or not, and he is in a position to decide on a better way of handling the work. Decreasing labor cost and increasing material cost is not successful management. A foreman may point with pride to the great amount of work his department is turning out when due to this cause, but what about the company he is working for? It will lose money.

Keep Down the Supply of Material.—In some shops the foremen do not think it worth their time to consider the cost of material. In cases where material is required and is not on hand they will order at least twice the quantity required, with the result that a large amount of money is tied up in the store department for material that may not be needed for the next 60 days. The result of this poor business method is far reaching, for the money that should be used for the pay roll is tied up in the store room on useless material.

Following are a few ideas that were worked out in a shop where the output was increased 50 per cent. in one year with no increase in the cost over the previous year.

Shop Schedule.—The repairs on an engine were classified and each class was given a certain number of days to be in the shop. Each department was given a schedule of the length of time allowed for the repairs for which it was responsible. This schedule also showed when the parts were to be received so that the foremen could not have the excuse that he had not received the work in time. With this system it was easy to locate the weak points and find the foreman who was the cause of the engine not leaving the shop on schedule time.

Advance Information as to the Repairs Required.—The general foreman was notified at least 15 days before an engine was due for the shop. At the same time he was given a condensed report of work that would be required, or of any thing that was not just right and would need attention. He would then send a copy of the notice and report to each foreman, who in turn would get out a list of any castings or heavy forgings that would be required and were not on hand. This one point made a great gain, for it not only gave the store department an opportunity to get material, but work throughout the shop could be handled in quantities instead of one or two pieces at a time.

Facilitating Delivery of Material.—All departments and erecting pits were spaced off and numbered, with a view of reducing the time required to deliver material to the engines. How easy (?) it is for a man to go up and down the shop with a truck load of material looking for some engine that does not happen to have a number 20 in. high painted on it. On the other hand if told to deliver material to space 25 he knows the exact location and the easiest way to get there without loss of time.

Engine Failures Posted in the Back Shop.—A large blackboard was placed in the back shop on which were listed the daily engine failures and their causes. Every road has engine failures and the best way to overcome them is to educate the men to do their work in a manner that will not cause a failure. This board was the direct cause of getting the men so interested in the good record of the shop that men from one department would check over work from another with the view of preventing an engine failure which would be charged against their shop.

An Unusual Kind of Staff Meeting.—Of course, every shop has a foremen's staff meeting, but how many shops hold staff meetings with the workmen? This gets the master mechanic and general foreman in close touch with every department. Each department should elect one man to be its representative and to hold that position for at least six months. Every month the department representatives, master mechanic and general foreman should hold a meeting and discuss shop conditions and different ideas of getting out the work. Some valuable ideas will be brought out at these meetings and weak points will be discovered and corrected, all tending to increase the output and at the same time decrease the unit cost. Some foremen do not take kindly to suggestions made by their men, but if these can be brought before the men's meeting and thoroughly discussed, it will often lead to some good point that has been overlooked.

Reclaiming Scrap.—Near the center of the shop a space was marked off for a scrap pile. One man was given the job of taking care of it. He had to sort it over and return good material to be used again; the scrap material he transferred to the scrap bins. It is unnecessary to give any figures on the amount of money that was saved. However, where two and three men had been kept busy wheeling out scrap to the scrap bins, all scrap is now delivered to the bins by this one man who looks after the shop scrap pile.

Co-operation.—It requires the hearty co-operation of every man in the shop to increase the output and at the same time decrease the unit costs. Ideas must be developed to secure and maintain the interest of every man. No one man can install and maintain a perfect system in a large shop without the help of every employe. Don't lose sight of the fact that the success of the company you are working for is your success, and increased output at a decreased cost means an increase in your present salary.

IMPROVED ORGANIZATION AND ITS EFFECT ON SHOP OUTPUT.

BY C. E. STONE.

General Car Foreman, National Railways of Mexico, Talleres de Santiago, Mexico.

While shop kinks, labor-saving machinery and good shop facilities contribute their part to increased output, their importance is secondary. The standard is set almost wholly by the man in charge on the basis of his ability to organize and handle men. The first and most important requisite is that he be a man in the fullest meaning of the word; being that, he will command the confidence and respect of his employers as well as of his employees. If he can maintain discipline and retain the good will and respect of his employees and the hearty co-operation of his fellow officers in the other departments his battle is almost won and a high standard is assured. He should ever strive to control himself and be able to administer a reprimand or give instructions even under the most trying circumstances without loosing his temper or using profanity, for that will lower him in the estimation of all present quicker than any other fault he may have. He should be a keen student of human nature and be able to look on all sides of any question.

He should be wholly devoid of partiality in settling controversies and handle every case strictly on its merits, not hesitating about applying the needed remedy. To err is human; therefore, when an error has been made, he should take the party at fault to one side and in a friendly manner attempt to show him the error of his ways and make him see that it is necessary to be more careful; if the error is on account of ignorance, he should be able and willing to impart the necessary information to prevent its repetition. If the person so handled is the right kind of a man the foreman has made a better em-

ployee for his company and a friend and supporter for himself. If one or two warnings do not have the desired effect the sooner the man is dismissed the better for all concerned.

Promotion from the ranks keeps hope alive and fosters ambition and is absolutely essential to increased output or high shop standards. The rank and file should be given to understand that vacancies higher up will be filled from their numbers, but strictly on a basis of ability. The writer is not an advocate of the seniority rule, and believes that it is detrimental to high efficiency, as it tends to keep ambitious men away from the shops where it is the rule and thus lowers competition.

The successful foreman must know what he wants to do and how he can best do it; then he must have confidence in himself that will inspire initiative, and the persistence and courage to keep everlastingly at it, until by sheer force of purpose he makes an impression. To be successful he must be conversant with the detail work of each of the branches over which he has supervision. Here he is the expert adviser as well as the expert organizer; he should clearly define the jurisdiction and authority of his subordinate foreman of each branch of the service and then grant them perfect autonomy so far as handling their men is concerned, making them understand that they are responsible for the results. He should keep in close touch with his foremen and invite their confidence, always treating them as men and making them feel that his time is at their disposal whenever they need assistance or advice about their work, at the same time teaching them the value and importance of self-reliance. He should transact all business with the foreman direct, never going to the men, as that weakens the foreman's prestige with them.

The duties of the several branches of the mechanical department are closely interwoven with each other, and harmony and co-operation between the men in charge of the different branches is of the greatest importance and must be maintained at any cost, or the standard of efficiency will be lowered. Study the conditions of your shop and see that each branch of the service has the right amount of help to keep pace with the other departments. This having been done and harmony and co-operation firmly established you will find that a good many points have been added to the shop output. Teach your foremen to specialize, as that is an important factor in increasing the amount of work turned out by each individual. Establish a friendly competition between the different branches, giving due praise to the foreman who has made the best record. Encourage the other fellow and put him on his mettle to make a greater effort; show him where he has made a mistake or why he has fallen behind, and instruct him how to overcome the weakness in his system of working and will nearly always deliver the goods.

Keep your foremen inspired and they in turn will inspire the men and your shop output will be increased far more than you had dared to hope for, and you will be surprised at the amount of suggestions you will receive tending to create greater facilities for further increases; some of these will be practical and can be put in operation to prove their value. In conversing with your superiors do not attempt to rob your subordinates of any improvement or record that they have made that is deserving of special mention, but give them the credit they deserve.

Last but not least, remember that it is the idle moments that test the character and that the foreman who uses his idle moments to improve his mind and add to his stock of knowledge easily leads in the race. Next in importance is to watch your leaks very closely; do not allow the waste of any serviceable material, be it old or new. Keep close watch of the scrap bins, as that is your principal leak, and unless properly taken care of will offset all your other efforts at securing a high efficiency. Systems for handling the work and shop kinks are local conditions and no fixed rule governing these will produce good results in all shops. There are many of these, all more or less beneficial, but the ones that will best serve the purpose must be left to the man on the ground, who knows the conditions existing at that particular place.

LOST MOTION.

BY CHARLES MAIER.

Engine House Foreman, West Jersey & Seashore, Atlantic City, N. J.

A well designed piece of machinery, even though it be ever so complicated, if all parts are properly fitted and put together and well lubricated will work smoothly, each part doing its share of the work. Lost motion or friction if it happens to be in a critical part or throughout the machine can reduce the efficiency to such an extent that the cost of the output will be considerably increased. All this is nothing new, but the comparison of a railway organization with it is so convenient that I have been tempted to mention it. If we could take up all the "lost motion" or eliminate all the friction in the railway organizations of the country the annual saving would probably be enormous. I am not going to try to show where all this lost motion or friction exists, because I cannot, but that some does exist I do know. All railways have numerous repair shops and repair yards, each of which is undoubtedly in charge of a capable man. However, no one of these men can be expected to have become so efficient in his work that he cannot learn something from another in the same line of work. A certain job may be handled in one place in an altogether different manner and considerably quicker and cheaper than at other places on the system. Some of the other places may be doing other jobs quicker and cheaper.

Every repair point that handles a job on which more time is spent on account of the method of doing it than is required at another point has lost motion that should be taken up. If the methods of doing similar work at all repair points could be compared the general efficiency would be considerably increased. This could be accomplished by sending out circulars from some designated office to all repair points asking for a detailed explanation as to how a certain job is handled at that point; when all replies are received they should be sorted out and sent to each repair point so each will have the benefit of the others' experience. When any of these places discover a new kink that will facilitate doing a piece of work it should be sent direct to the central office and from there distributed to all repair points doing that class of work. Some roads do have a system of collecting shop kinks but it is not on as broad a scale as this and is not conducted as systematically. Suggestions or kinks come in at random and may never get further than the division on which they originate. Notices should be posted at all repair points asking the men to send any new ideas they may have direct to the office collecting them and if any man, be he a mechanic or laborer, does send in a new idea that is worth adopting give him substantial credit for it in some form. Most every man would like to get up some new and better method of doing a job or some new tool, and he would be stimulated considerably if he thought he was going to get something for it. An annual pass over the division if given as a reward for a new suggestion would encourage not only the man receiving it but all his fellow employees.

Mechanics often have good ideas on handy tools to do certain jobs or quicker methods of doing them, but cannot get them in shape for various reasons. They may be kept so busy they do not have time to make tools, or perhaps a narrow-minded foreman will not permit them to try new methods. Some foremen of this class seem to think a man is trying to tell them their business if he makes a suggestion. Some of these suggestions may seem trivial but they may apply to operations all over the system and in the aggregate the saving effected would be considerable.

Some of the most successful industrial concerns have been doing this for years with splendid results. The employees make suggestions, some of which are patented and the employee receives an annual royalty. The result is that each employee is using his or her brains continually, on or off duty, trying to get some new idea in connection with their work. Instead of a comparatively few officials trying to overcome all the difficulties that present themselves the entire organization is at it all the time. A concentration of this kind is bound to produce results and create a better feeling between officials and employees.

INCREASING THE OUTPUT OF A SMITH SHOP.

BY J. F. PERRITT.

Blacksmith Foreman, Seaboard Air Line, Jacksonville, Fla.

In reading over the announcement of the competition on Increasing Shop Output, I was attracted by the following sentences relating to the department I am most interested in: "The blacksmith shop never could quite keep up with the work; now you are easily doing so, although you have more work to do and have not increased your force. How did you bring it about?" Without presuming to be an authority on the management of the smith shop, I shall attempt to answer this question by describing the practices and principals by which the output of one smith shop was increased, although the force suffered a slight decrease.

The Relation of the Smith Shop to the Other Departments.—The problem that confronts the management of a railway repair plant is the general output. But it is a fact generally admitted that the blacksmith shop, being practically the initial point of the general run of repairs, should at all times be in advance of the other iron working departments. Otherwise, the boiler shop and machine shop would be held back and the heads of these departments prevented from making the showing they might be capable of.

Building Up An Organization.—In order to place the smith shop in advance of the other departments and to keep it there, more than one problem has to be recognized and dealt with. Probably the first of these is to build up the organization by securing good workmen who are sober, steady and conservative men. In this day when workmen are more educated and refined (thanks to our public school system), there is no great difficulty in doing this, except that it requires time. Once the organization is perfected it is hazardous to break into it, even temporarily, by employing a smith who is lazy, a hard drinker or an agitator. In using the word agitator I wish to be plainly understood. A good union man is a credit to himself and his craft. But an agitator is of no service to a union, or a shop, or himself. After successfully organizing a shop it is necessary to exercise great care in order to maintain the organization. The men should be treated kindly and firmly and with a uniformity that will insure their respect and confidence in the foreman. If a man is not genteel enough to appreciate this sort of treatment and shows a disposition to take advantage of it, don't demoralize good conditions by quarreling with and threatening him; dismiss him from the service. The men will be better off without such a man among them.

If, as in most cases, the men are working under certain shop rules or an agreement, agreed to and signed by the superintendent of motive power, the foreman should preserve a strict regard for these rules by living up to them to the very letter. By so doing he can with a greater impunity exact the same of his men. Should any irregularities originate, sufficient to lead the men to believe a grievance has been perpetrated against them, settle it by the rule book. If the rules are not explicit enough to determine a satisfactory settlement, a spirit of fairness will prompt the foreman to willingly refer the matter to the general foreman or master mechanic for a ruling.

Classification of Work.—Next to, or in connection with organizing the shop, should come the classification of the work. It should be distributed among the men in accordance with their ability. This will insure a more speedy and accurate output, and to a certain extent eliminates the necessity of the foreman closely watching and measuring each piece of work turned out, thus giving him more time to attend to his other duties and for studying out and making improvements. The field of blacksmithing, like many other trades, is so broad that one man can not cover all of it and give perfect satisfaction in all of its branches. For instance, a smith may be perfectly at ease working a frame, rocker arm, or mud ring, who could not, in a given time, make a respectable wrench or hammer to save his life, while a very ordinary smith, not able to give satisfaction on the former pieces, would be perfectly at home with the latter. Often it is the small jobs that prove to be the most puzzling and lots of time is lost in turning them out if they are not given to a smith familiar with them.

There are three fires in the average smith shop that are looked on as special fires, whether they are so designated or not. They are the spring fire, the tool fire, and the frame or heavy fire. In a number of shops only one man is familiar with any one of these three classes of work. This is all wrong, as circumstances may deprive the smith shop of the service of either of these men for days or weeks, or for an indefinite period. It is, therefore, necessary to have more than one man familiar with each different class of work. Where thermit is used for welding frames, more than one man should be taught to handle it. It is next to an impossibility for the foreman to superintend every job of this kind and give sufficient attention to his other duties.

In classifying the work, however, it will not be necessary, nor would it be justice to the men, to keep them on one kind of work all the time if they are capable of doing other and better work than the kind usually assigned them. Numerous opportunities will arise which will permit the foreman, without endangering the output, to try a man on a different class of work and if he proves capable of doing it satisfactorily, he becomes more proficient and consequently a more valuable employe.

Tools and Equipment.—After organizing the shop forces and classifying the work, comes the important feature of equipping the shop with tools. Only a limited amount of work can be gotten from a man's backbone and muscle, but the amount of work to be gotten from the use of improved tools is unlimited; at least the limit has never been reached. As a matter of fact, with the general run of work in the average railway shop, a special tool can be made to help with or complete pretty nearly every job. The class of tools demanded for the smith shop is regulated by the number or kind of machines installed therein. If a foreman has bulldozers, bolt headers, and forging machines, his task will be confined chiefly to making dies and formers for these machines. But even without these machines, he is expected to get results and to continually increase the output and decrease the cost. If the management will not buy the necessary equipment, it is up to the smith foreman to build machines or air presses of such shapes and dimensions as are required to do the work. Work which cannot be done on the air machines, must be done with steam hammer dies and formers and punches. A great number of these tools can be built similar to tools used in other shops, or tools illustrated in railway papers and magazines. Not an easy task to be sure! But with each good, serviceable tool, the output is increased so materially that the foreman and his men feel amply rewarded for their efforts. It is bad policy to ignore a suggestion from one of the men regarding his ideas of a tool. If the ideas are practicable adopt them. If impracticable, reason with and convince him of the fact. You may need his ideas again some day, and the co-operation of the men with the foreman in making improved tools is a good thing to encourage.

With the average railway management changing standards from time to time, and purchasing engines or cars of a different type or build from those already in service every few months, the necessity for making tools to cheapen the cost of repairs never ceases. When not able to make all the tools required at once, the foreman should make tools for the work that gives him the most trouble. If this is done he will much more quickly find time to build the others needed. However, a smith shop might be literally stocked with good tools, and if they are not kept in order so that they can be found quickly when wanted, the company will not be getting the full value of them, nor will the foreman be increasing the output as he might. Hence making and having tools is not the whole problem. They should be arranged and kept systematically so that no time will be lost in finding them when needed, and also that the foreman can at any time look them over and see just what tools he has and their condition.

Take Advantage of Hot Metal.—One of the practices most effective in increasing the output is to take advantage of a piece

of hot metal. For instance, a machinist orders one knuckle pin. It takes more time to heat an axle (of which these pins are usually made), than it does to make the pin. And as a smith can easily make two of these in one heat, have him do it and while the other portion of the axle is half hot and the fire is in prime condition for heating it again, if you can spare the time make a dozen or more. The smith foreman thus saves time and keeps ahead of the machine shop. This practice is helpful in making many pieces, such as knuckle pins, wrist pins, piston nuts, brake hanger studs, guide blocks and any standard article blocked from a heavy piece of metal.

Co-operation of Other Departments.—Increasing the smith shop output becomes more easy if the smith foreman can induce the various foremen of the other departments to send their repair work to him as promptly and orderly as is practicable. Time is saved in doing this work collectively, but is lost if it has to be done piecemeal.

The stock of iron and steel on hand should be watched closely and a sufficient amount should be ordered each month to take care of the work.

One of the best methods of getting and keeping a body of hustling blacksmiths, is for the foreman to get busy himself in attending to his duties, thus setting an example for his men. An indolent foreman does not place himself in a position to consistently expect much from his men. The idea that when one is promoted to a foremanship he ceases to work, is all wrong. The promotion means work, and hard work if one cares to succeed.

THE LOCOMOTIVE REPAIR SHOPS OF THE BURLINGTON AT HAVELOCK, NEB.

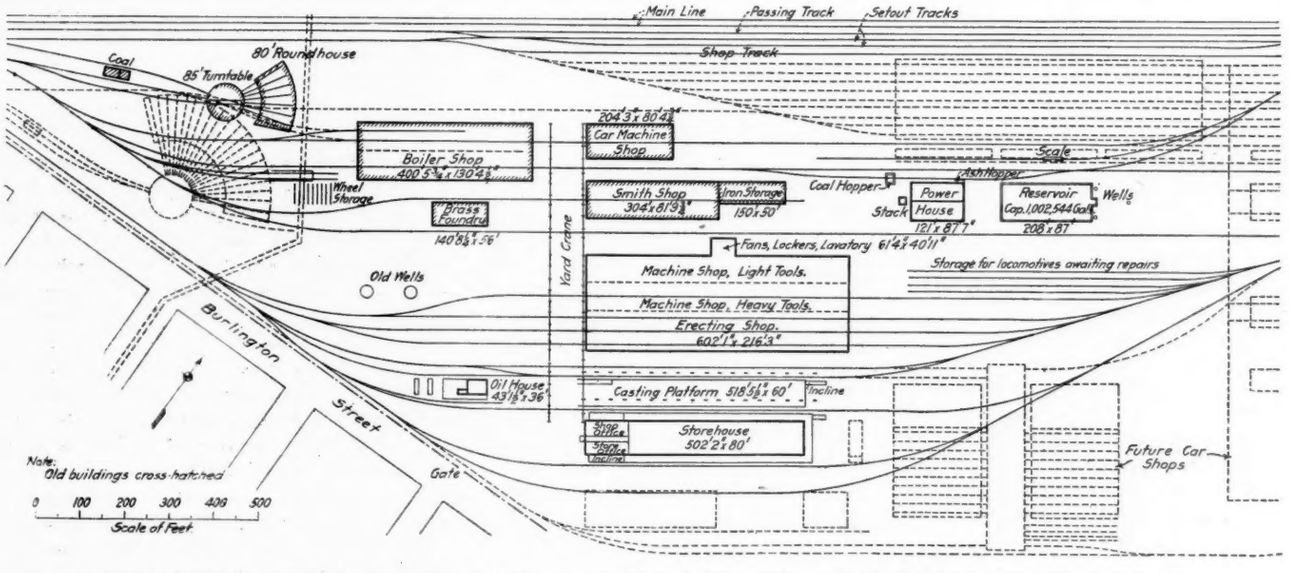
[WITH AN INSET.]

The original locomotive shops of the Chicago, Burlington & Quincy at Havelock, Neb., were built in 1893 and 1894. In recent years there has been felt the necessity for larger and better facilities for repairing locomotives at that point. The introduction of heavier power for both freight and passenger service, and the large number of Mallet compounds in use, rendered the old shop equipment inadequate for handling this work in an economical and rapid manner. Havelock is located about 4 miles east of Lincoln, Neb., on the main line between Chicago and Denver. Lincoln is an important point, as it is the junction of the lines running between St. Louis, Mo., Kansas City, Kan., and Billings, Mont., and between Chicago and Denver, as well as the termini of several branch lines.

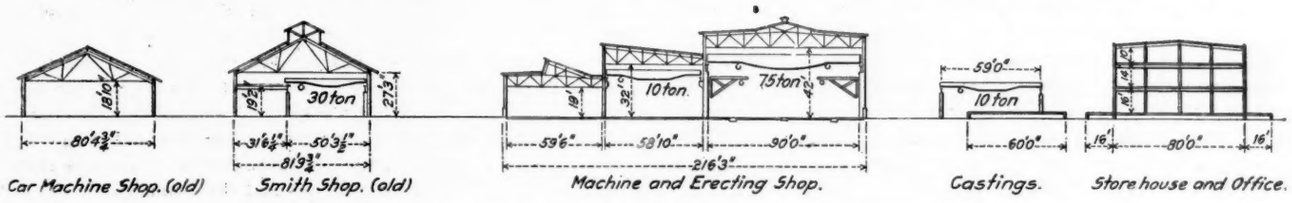
During the past year substantial improvements have been made in the plant at Havelock by the addition of a new power plant, a large locomotive erecting and machine shop, a storehouse, a casting platform with an overhead crane, and an oil house. The new buildings, together with those now existing and shown as shaded areas on the general plan, will give a shop layout as follows: Erecting and machine shop, 600 ft. x 215 ft.; boiler shop, 400 ft. x 130 ft.; smith shop, 300 ft. x 80 ft.; storehouse, 500 ft. x 80 ft.; power house, 120 ft. x 87 ft.; car machine shop, 200 ft. x 80 ft.; brass foundry, 140 ft. x 56 ft.; and oil house, 65 ft. x 36 ft. The oil house basement is 101 ft. x 38 ft. The enclosed superstructure is 66 ft. x 38 ft.; the balance is covered by a steel canopy, 35 ft. x 38 ft., and is open at the sides.

The new erecting shop has longitudinal tracks with space for 36 locomotives under repairs. There are three tracks, each 600 ft. long and equipped with pits. General repairs, not including new fireboxes, will be made in 15 days, and 45 engines per month will be the normal capacity of the shop. There are now about 600 locomotives on the Burlington lines west of the Missouri river, which will be tributary to the Havelock shops for general repairs.

The location of the new buildings was determined by the projection of a crane runway which would join the ends of the old buildings with those of the new; as shown on the plan the 80-ft., 40-ton, yard crane extends between the three old buildings and the end of the new erecting shop and the storehouse platform. The names marked on the old shops indicate the purpose for which they will be used when the new shops are in operation.



General Arrangement of the Havelock, Neb., Locomotive Repair Shops of the Chicago, Burlington & Quincy.



Cross-section Through the Center of the Locomotive Repair Plant.

That marked "Boiler Shop" is the old erecting shop. The old smith shop is to be converted for the present into a woodworking shop for locomotive cabs, underframes and other woodwork required about a locomotive shop. The old boiler shop will be converted into a smith shop and the old power house is to be used as a brass foundry.

ERECTING AND MACHINE SHOP.

This building is similar to some of the western shops built in recent years in that it has a longitudinal erecting shop. It is different from those shops, however, in that the boiler work is not done in the same building and the machine shop is located on one side only of the erecting shop instead of on both sides, as at the Topeka, Kan., shops of the Santa Fe and the Parsons, Kan., shops of the Missouri, Kansas & Texas.

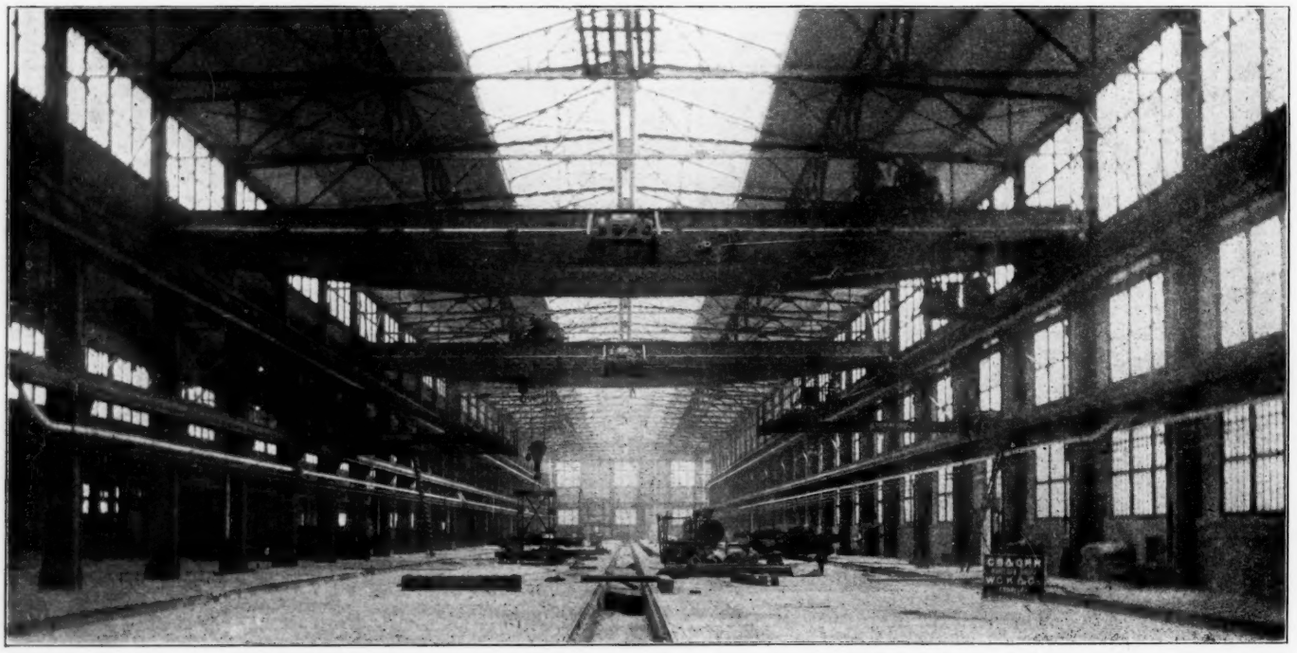
The building consists of an erecting bay and two machine bays, and has a cross section wholly unlike any other longitudinal shop in this country. The erecting shop has a height of 42 ft. under the roof trusses, a clear width of 90 ft. and a distance between track centers of 30 ft. 6 in. Three tracks run the entire length of the erecting shop. The machine bays are each 60 ft. wide, center to center of columns. The bay in which the heavy motor-driven tools will be located has a clear height under roof trusses of 32 ft., while the small tool bay, which will contain both group and motor-driven tools, has a height of 19 ft.

A substantial steel construction forms the framework of the building. The walls are built on 1-in. channel studding tied with iron straps to the steel girths, and covered with galvanized expanded metal, wired on. To the expanded metal is applied four coats, or layers, of cement plaster each ¾-in. thick, which gives a wall having good weather-resisting qualities and enough thickness to imbed the steel and protect it from destructive corrosion. The base walls up to the windows are of brick.

The floor of the erecting shop is of concrete cast in 5-ft. squares, and has 1½-in. crowning between the tracks for drainage to the pits. The floor of the machine bays consists of a course of 3-in. Burnettized Oregon fir laid on tamped Platte river sand, the boards being nailed together. Over this sub-floor is laid a wearing surface of 1⅛-in. maple factory flooring nailed with heads countersunk ¼ in. The roof of the building consists of 2-in. fir sheathing laid on 6 in. x 14 in. purlins and covered with five-ply pitch felt and gravel laid according to the Barrett specification. All of the window frames, sash and doors are of wood, and these portions, together with the roof, floor, tool room partitions and work benches, comprise all of the combustible material in the building.

The erecting shop is equipped with two 4-motor girder cranes, each having a main hoist capacity of 75 tons and an auxiliary hoist capacity of 15 tons. Serving the outside tracks are four

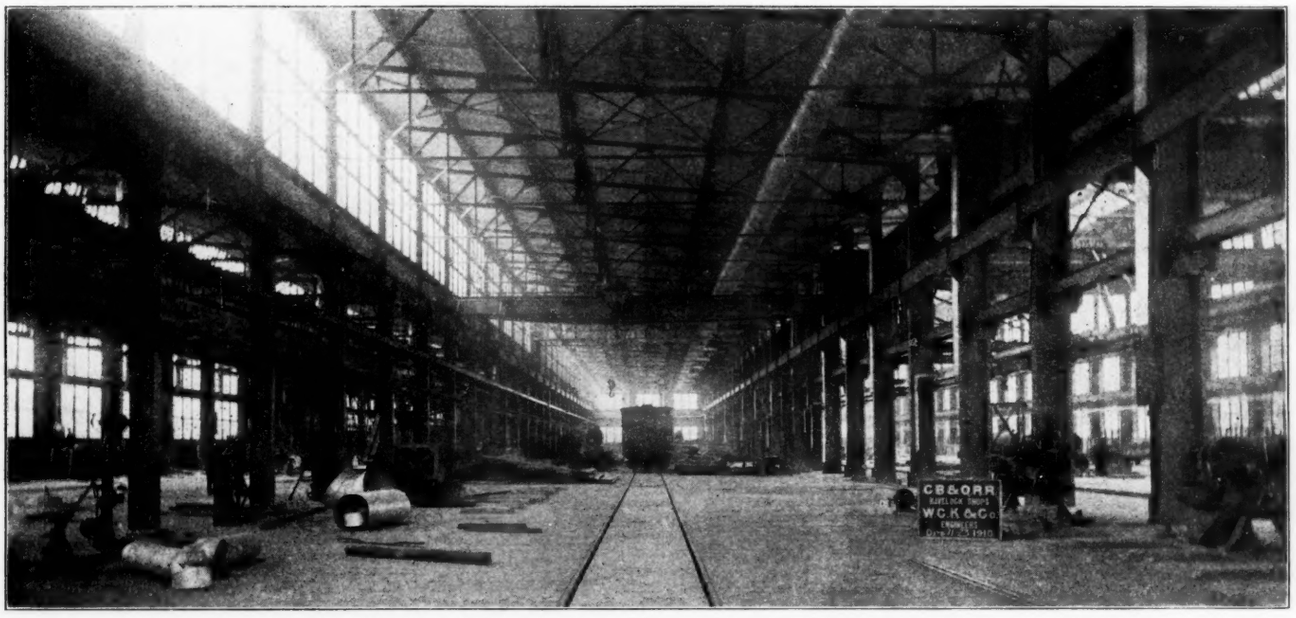
General View of the Havelock Locomotive Repair Shops, Chicago, Burlington & Quincy.



Erecting Shop Showing Two 75-Ton Girder Cranes and Four 3-Ton Traveling Wall Cranes.

3-motor 3-ton traveling wall cranes, two on each side of the shop. This type of crane is found only in one other locomotive repair shop in the country—in the erecting shop of the Pennsylvania Railroad at Altoona, Pa., which was last built.

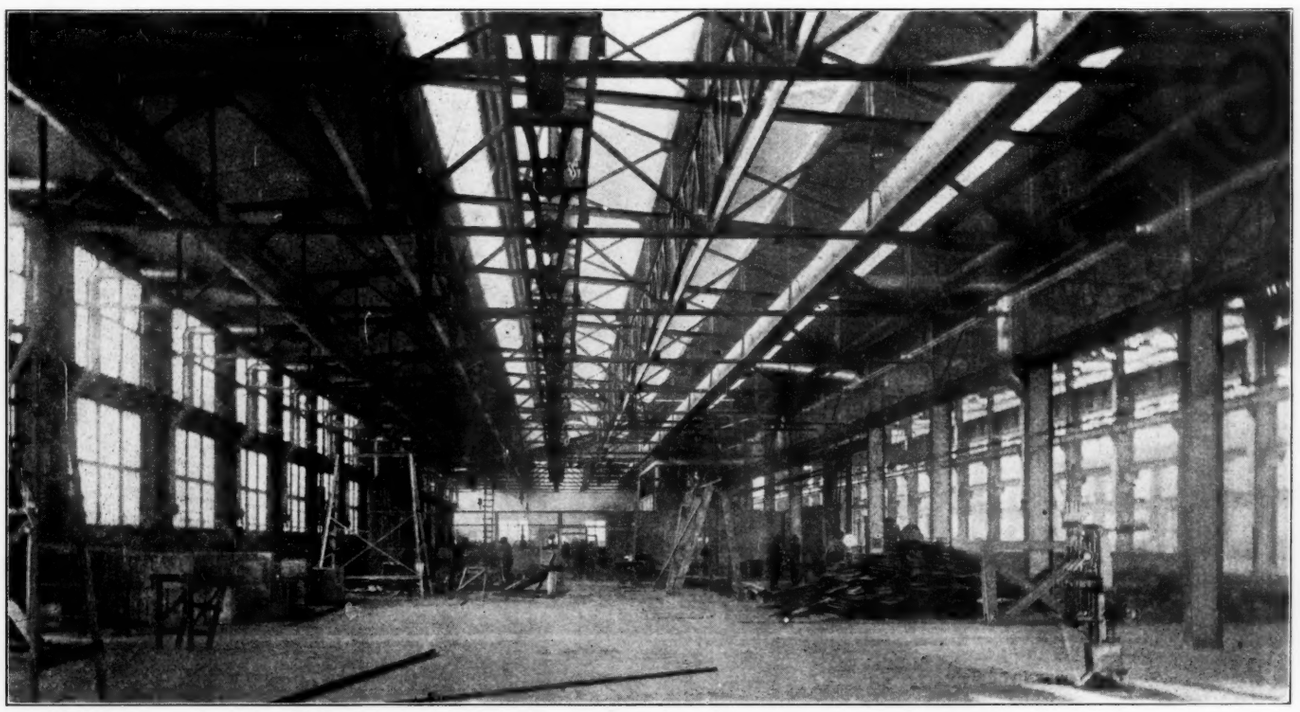
Steam, air, water and lighting service connections are provided in the pits, making it unnecessary to have hose and lamp cords on the floor of the shop. This system has been worked out thoroughly and a substantial and convenient arrangement is the result. The pipes are carried overhead and down alternate central columns, where valves are provided. The air pipe is first connected to the top of a small vertical drum at each drop. The outlet pipe passes through the bottom of the drum with the inlet pipe near the top. A drip pipe is provided for draining water from the drum, and in this way comparatively dry air will be supplied to pneumatic tools and hoists. The lighting of this shop as well as that of others is in the nature of general illumination, 110-volt alternating current, multiple enclosed arc lamps being used throughout, except in the smith shop, where flaming arc lamps appear to be more desirable on account of the smoke.



Heavy Machine Bay of the Erecting and Machine Shop.

The lye vat for cleaning the locomotive machinery is at one end of the erecting shop. It is made of concrete with cast iron grid plates around it in the floor. The vat has a sheet iron cover and is built with flues for carrying off the vapor from the hot water.

The middle, or heavy, machine bay is equipped with a 3-motor girder crane having a capacity of 10 tons and a span of 58 ft.



Small Machine Bay of the Erecting and Machine Shop.

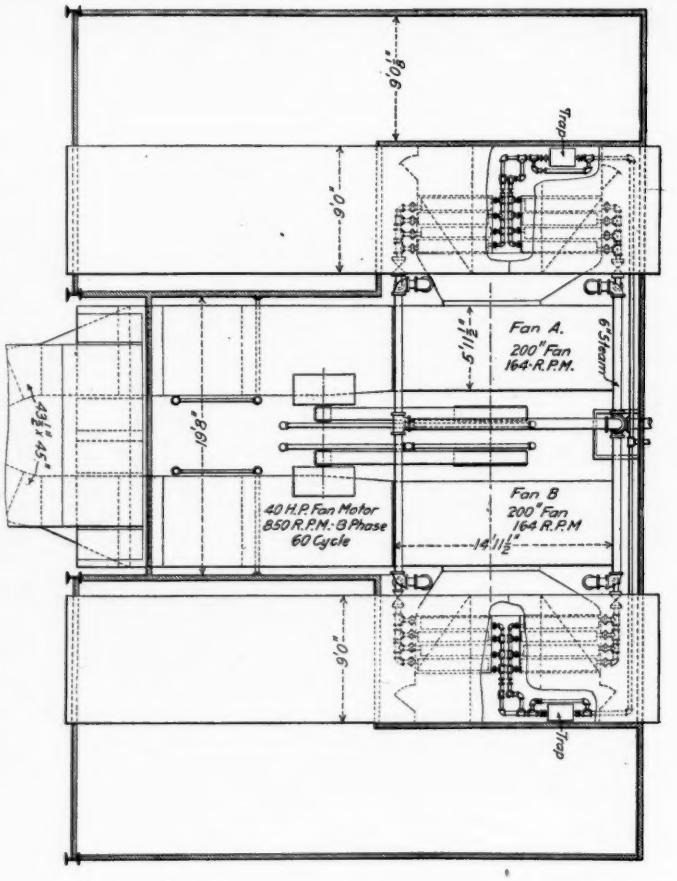
As soon as shop requirements indicate that it is needed, another crane of the same capacity will be installed on the same runway. All of the cranes in the shop, as well as those over the casting platform and runways, were built by the Niles-Bement-Pond Company. Direct current at 220 volts is used for the operation of all cranes in the shops. At the north side of the small machine bay at the center of the building is a projection 60 ft. long by 40 ft. wide containing the toilets, lavatories, lockers and fans for heating the building. The hot blast system of heating employs two immense fans 120 in. in diameter, each driven by a 40 h. p. electric motor. The fans were supplied by the Bicalky Fan Company, Buffalo, N. Y., and the cast iron radiating units are Vents radiators made by the American Radiator Company. Under normal conditions sufficient heat will be obtained from the exhaust system, though provision is made at the power house for a live steam supply when necessary.

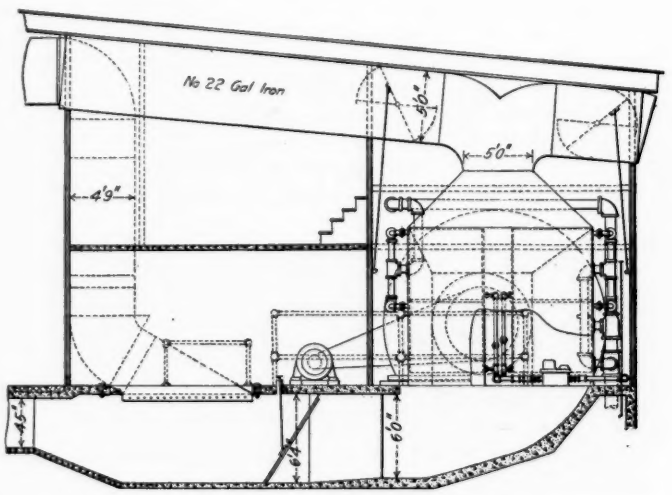
Located at different places in the shop are 6 combination urinals and drinking water fountains built of slate. The end doors of the shop have a vertical lift and are balanced, their movement being controlled by pneumatic cylinders. Most of the machine tools are driven direct by alternating current motors; the cranes and a few of the tools by direct current motors; and groups of small tools, including those in the tool room, by shafting. There are six groups of these tools and all of the shafting is 3 in. in diameter, making a uniform size for the couplings, hangers and pulley bore.

The location of tools in the machine shop is plainly shown on the large plan, which also indicates the kind of motors and the various groups of tools, including those driven by shafting and those intended for special work.

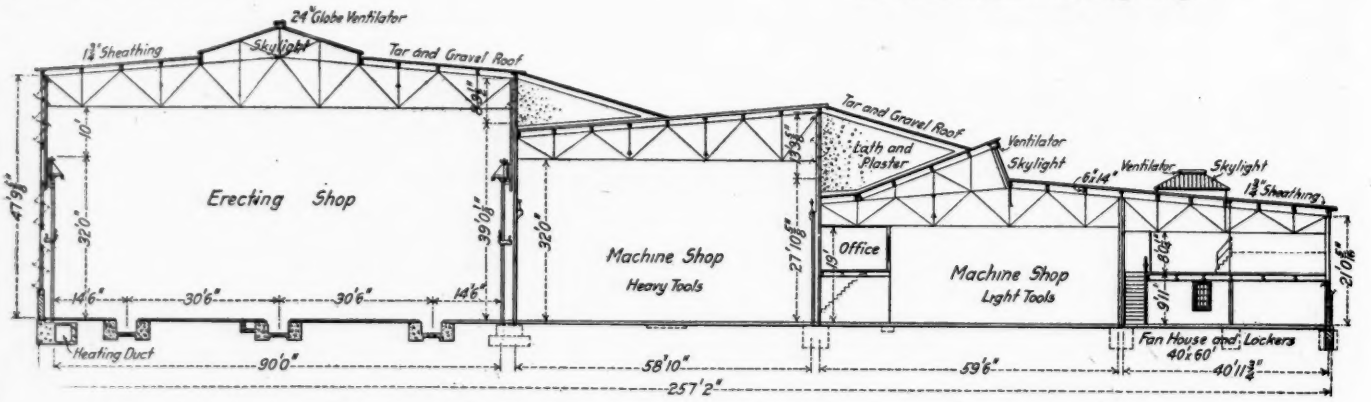
POWER HOUSE.

The east building of the group is the power house, a building thoroughly modern in every respect. The structure is of brick with a concrete roof, water-proofed with a 5-ply felt, pitch and gravel covering. Special attention has been given to the economical handling of coal and ashes, the former being handled by an inclined belt conveyor from the usual depressed track hopper to concrete bunkers situated in front of and above the boilers. This conveyor was supplied by the Stephens Adamson Manufacturing Company, Aurora, Ill. Ashes are elevated from the ash tunnel beneath the boilers to an overhead bin by means of a skip hoist operated by a motor. The boiler room is equipped with four 400-h. p. Stirling boilers, furnished by the Babcock & Wilcox Company and arranged in two batteries. Space is also provided for the installation of two additional 400-h. p. units. The boilers are equipped with the improved Green chain grate stokers. Other boiler room equipment consists of two Blake pot valve 14 in. x 8 in. x 12 in. outside end packed plunger type duplex boiler feed pumps and a 3,000-h. p. Stillwell feed water heater located on a platform above the boiler feed pumps. The chimney is made of reinforced concrete 200 ft. high and 9 ft. in diameter at the top, built by the General Concrete Construction Company. A Locke damper regulator is installed to control the draft.

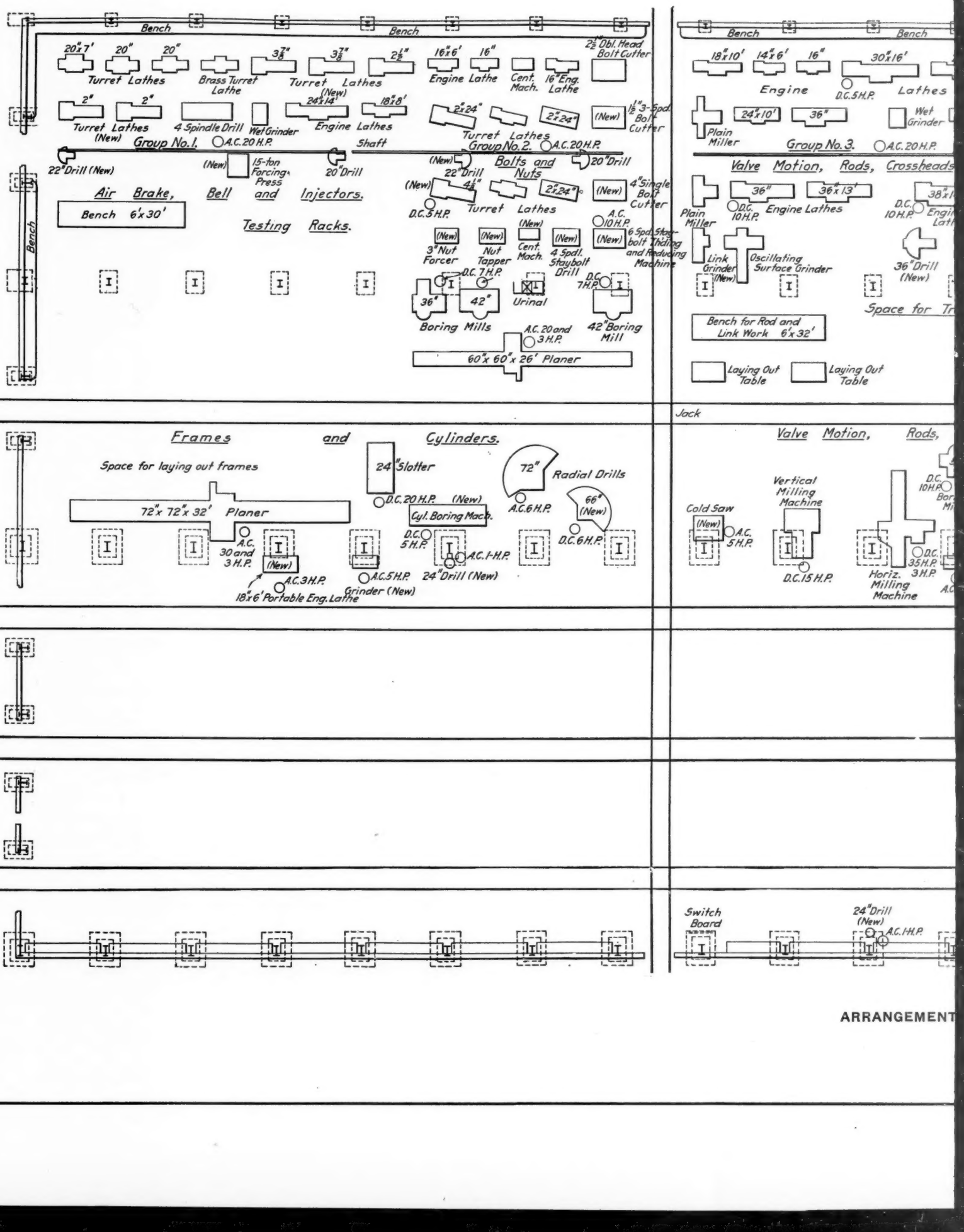




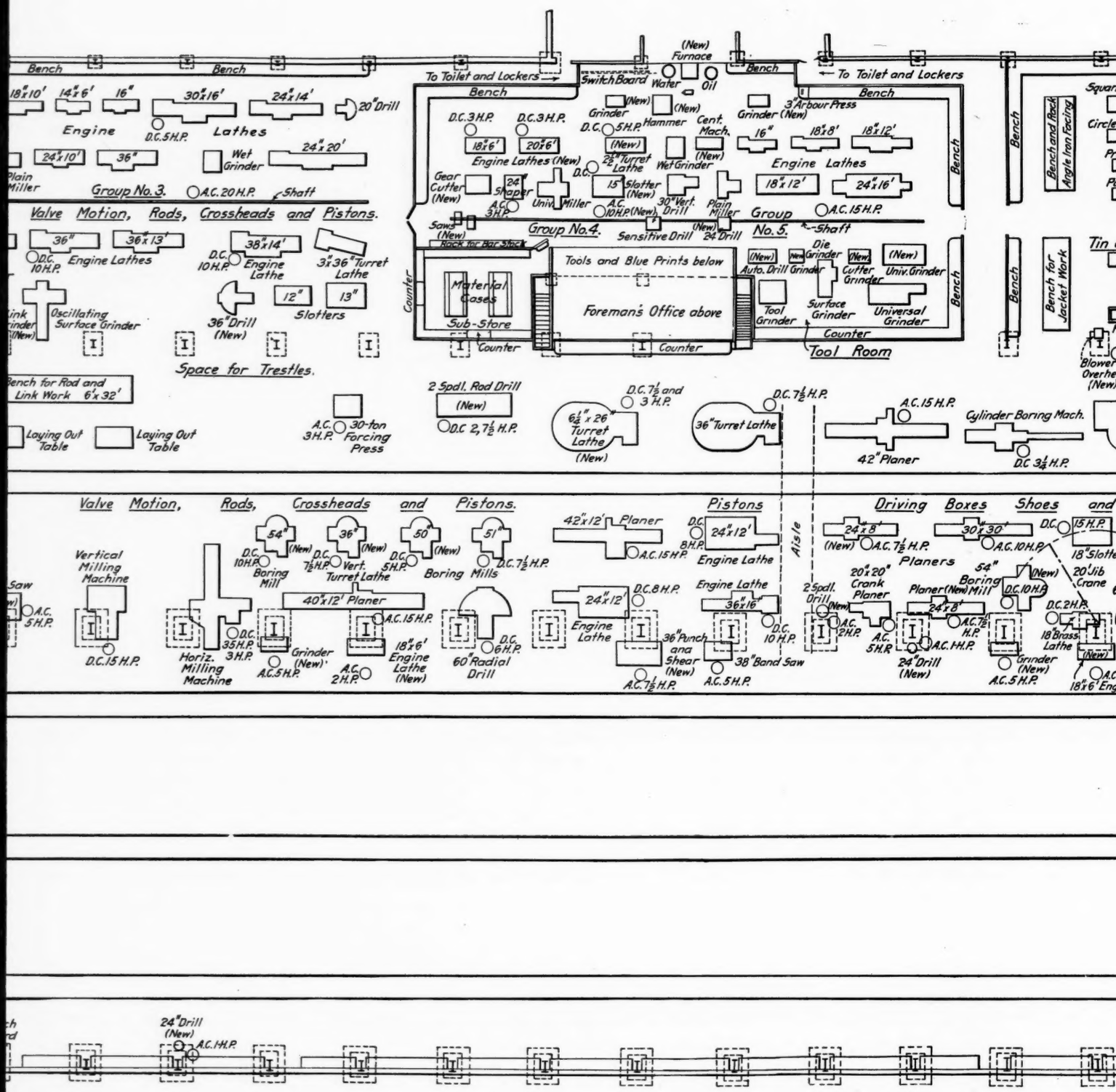
Arrangement of the Fan Room for the Heating System of the Machine and Erecting Shop.



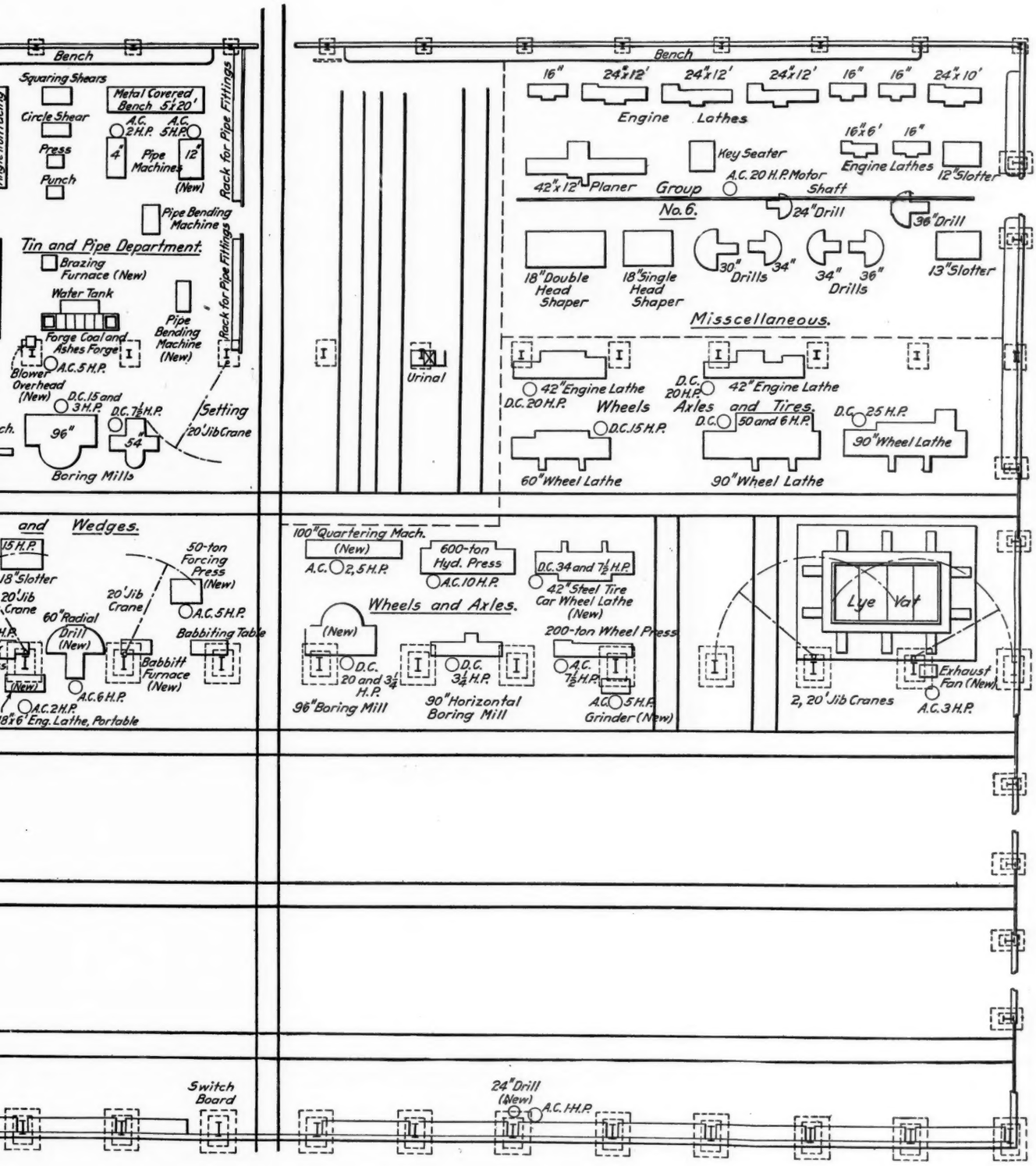
Cross-section Through the Erecting and Machine Shop Building.



ARRANGEMENT

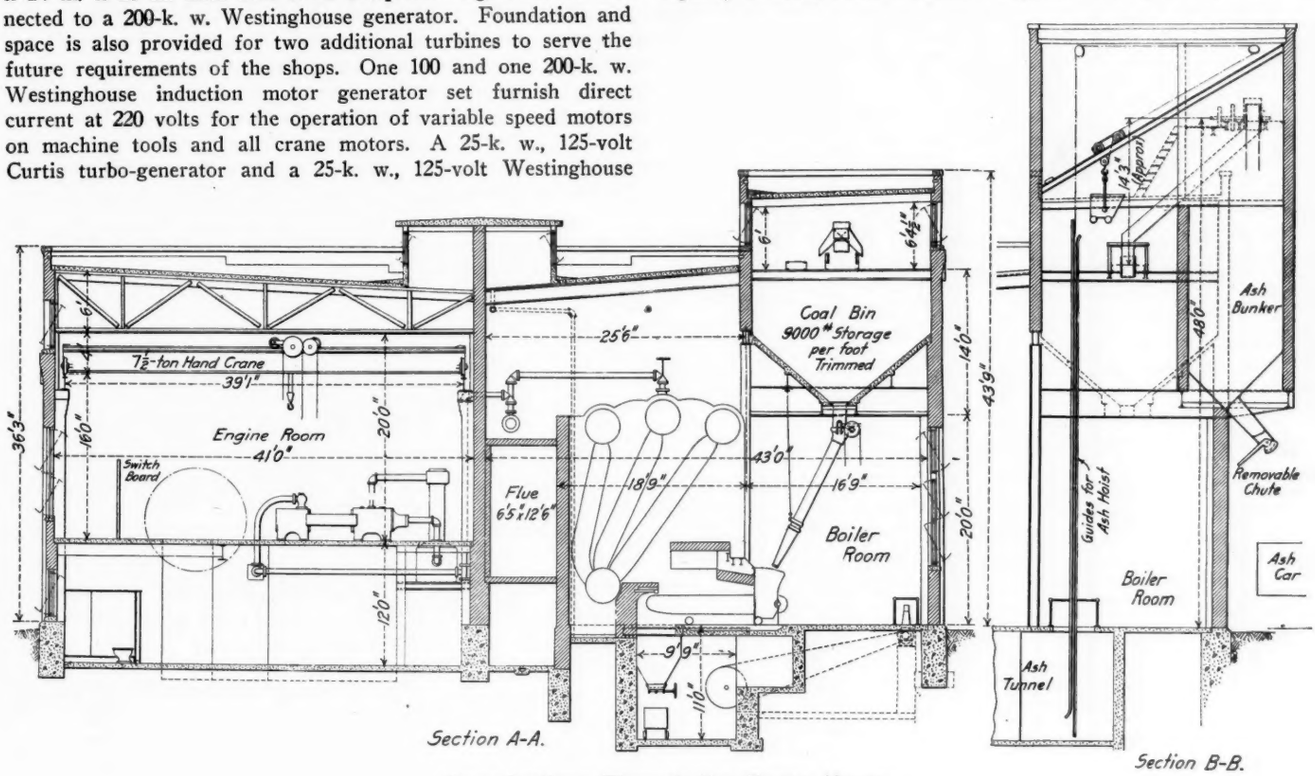


ARRANGEMENT OF MACHINE TOOLS IN THE CHICAGO, BURLINGTON & QUINCY LOCOMOTIVE REPAIR SHOPS AT HA

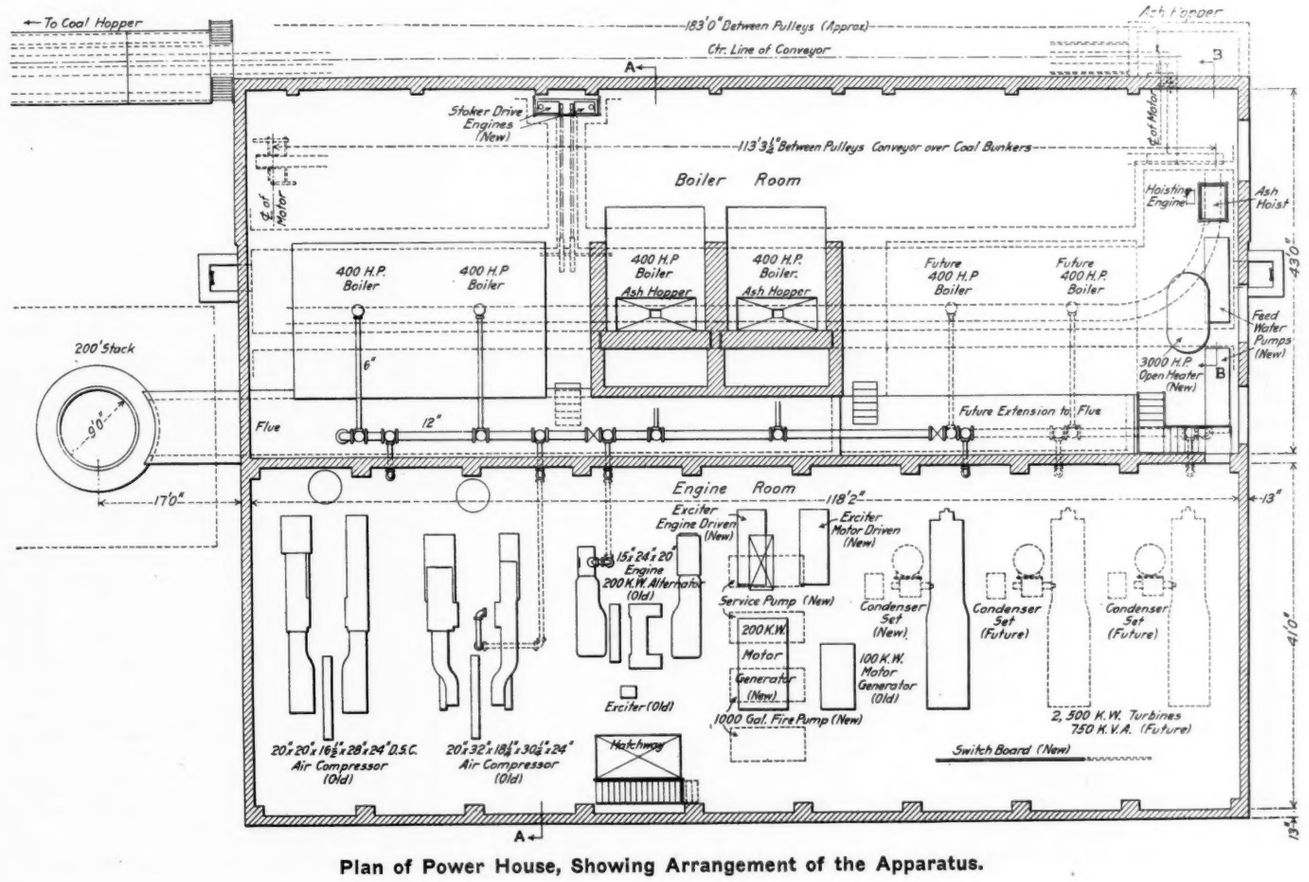


T HAVELOCK, NEB.

Three-phase, 60-cycle, alternating current at 440 volts is generated for lighting and the operation of all constant speed motors throughout the plant. The current is supplied by one 750 kilo volt ampere Westinghouse Parsons turbine and a 300-h. p. 15 in. x 24 in. x 20 in. Erie Ball cross compound engine direct connected to a 200-k. w. Westinghouse generator. Foundation and space is also provided for two additional turbines to serve the future requirements of the shops. One 100 and one 200-k. w. Westinghouse induction motor generator set furnish direct current at 220 volts for the operation of variable speed motors on machine tools and all crane motors. A 25-k. w., 125-volt Curtis turbo-generator and a 25-k. w., 125-volt Westinghouse motor generator set are provided for exciting and auxiliary lighting purposes. The equipment for compressed air consists of an Ingersoll-Sergeant cross compound, two-stage, 20 in. x 32 in. x 18¼ in. x 30¼ in. x 24 in., class G air compressor having a capacity of 2,100 cu. ft. of free air per minute, and a Franklin



Cross-Sections Through the Power House.



Plan of Power House, Showing Arrangement of the Apparatus.

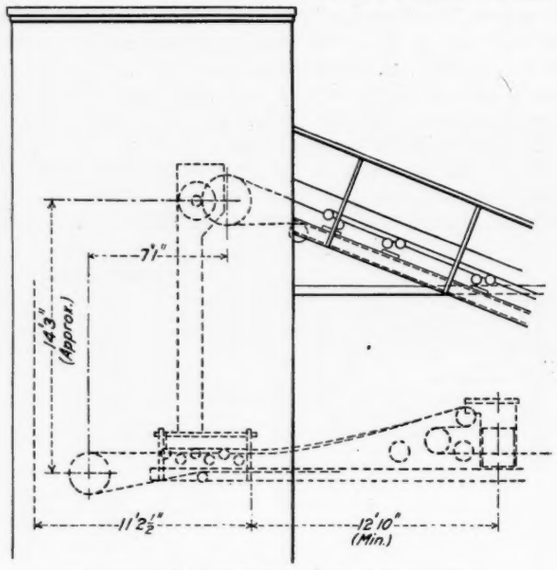
duplex 20 in. x 20 in. x 16½ in. x 28 in. x 24 in., two-stage compressor of 2,000 cu. ft. capacity. These are part of the old power plant equipment. Located in the basement of the engine room are two 16 in. x 14 in. x 18 in. Warren duplex service and fire pumps. A 5¼ in. x 4¾ in. x 5 in. Blake duplex pump for furnishing drinking water to the various shop buildings and a Westinghouse-LeBlanc No. 4 motor-driven condenser for handling the steam from the 750-k. v. a. turbine are also provided.

Adjacent to the power house is a large concrete reservoir 206 ft. x 85 ft., having a capacity of 1,000,000 gal., which contains the water supply for the shops. This reservoir is also used for cooling purposes, the discharge from the turbine condenser being sprayed through Koerting nozzles. An auxiliary reservoir furnishes the supply of drinking water, and is so arranged that the excess overflows into the main reservoir.

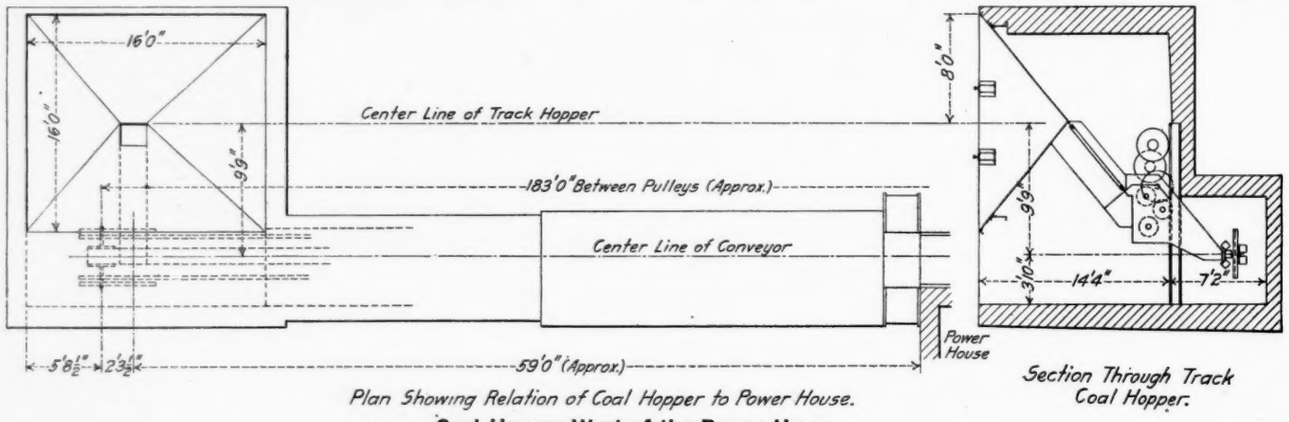
All piping between the power house and the various buildings is carried in concrete tunnels, the larger sections of which have the bottoms, sides and tops cast solid. Where the space required for piping is not large the tunnels are in the nature of conduits with removable concrete slab tops. The power transmission wiring is entirely overhead construction, being carried on steel towers and wood poles.

STOREHOUSE.

This building, which is intended to be the main distributing center for material used on the Western grand division, is of slow burning mill construction with brick walls, and is one of the largest railway store buildings in the country, being 500 ft. long by 80 ft. wide and three stories high. Surrounding the building on three sides is a platform 16 ft. wide to facilitate the handling of material. One hundred feet of the first and second floors of the west end of the building is reserved for office use. On the first floor offices are provided for the superintendent of shops and the storekeeper, and on the second are located the stationer, the medical examiner with an emergency hospital fully equipped, and the telephone exchange. There is also space for the apprentice school and a meeting room. The offices are all finished in yellow pine, varnished, and have plastered walls. On the first floor are also located the cases for holding the material handled in largest quantities and the receiving and shipping rooms. The stationer's stock room and material cases for handling small stock are on the second floor, while all material in original packages which is not worked over in the storehouse, or is of bulky nature, is stored on the third floor. The material cases are arranged in three rows.

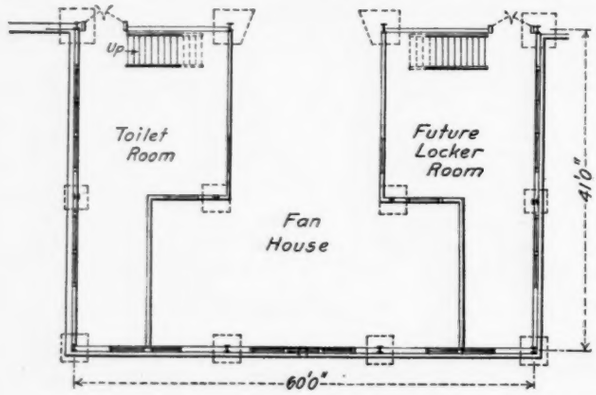


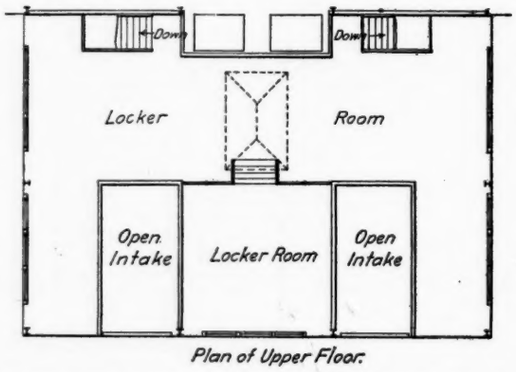
Elevation Showing Relation of Conveyors.



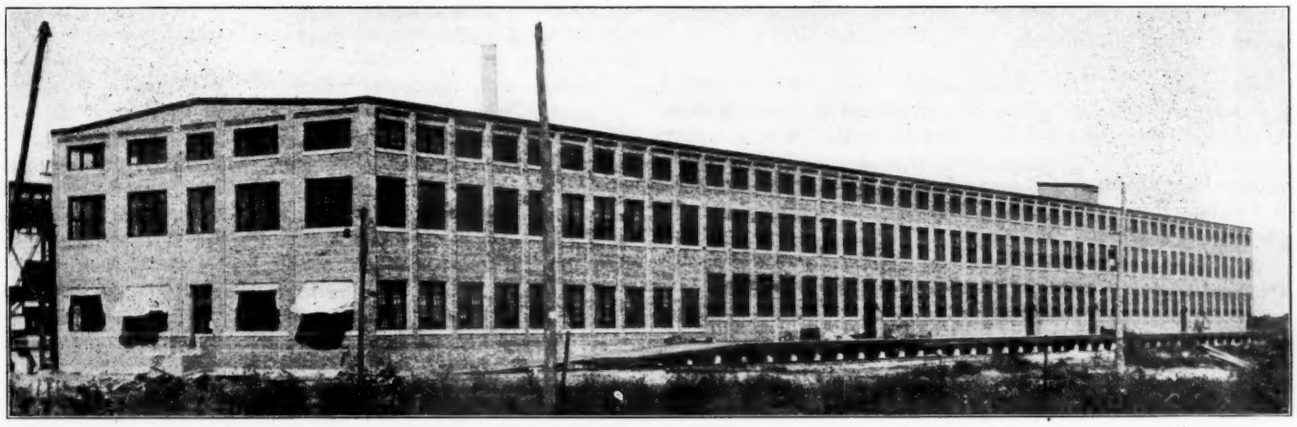
Coal Hopper West of the Power House.

An interesting fact regarding the design of the store building is that a form of material case was first adopted and the window spacing arranged to give a maximum of light between cases.





Plan of the Lower and Upper Floors of the Addition to the Machine Shop Containing the Fan and Locker Rooms.



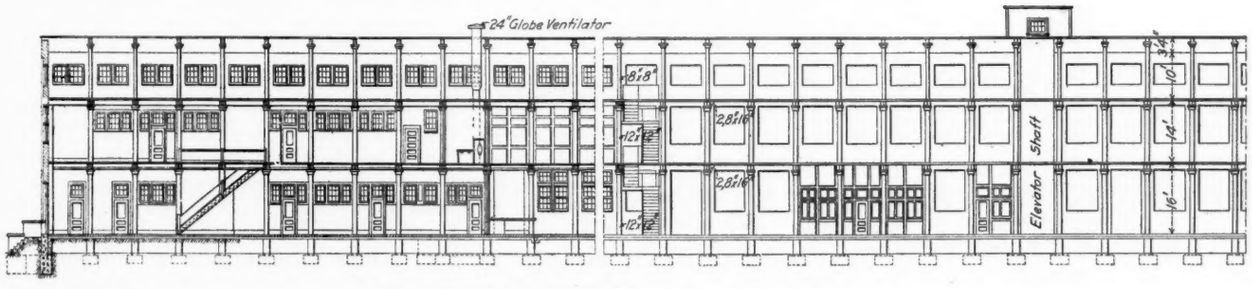
Storehouse, Havelock Shops, Chicago, Burlington & Quincy.

The material cases are 5 ft. wide at the bottom and are separated by a space of the same width. This arrangement gives a case spacing of 10 ft. center to center and 7 ft. of window between two adjacent cases. The office portion of the building is heated by direct radiation, while the storeroom is warmed by an indirect system having duplicate fans, motor-driven, which induce the air through banks of American Radiator Company "Vento" cast iron heating units using exhaust steam from the power house. Two motor-driven elevators are installed in the building, one being located in the receiving room and the other in the shipping room. The building is lighted throughout by incandescent lamps with all wiring in conduit.

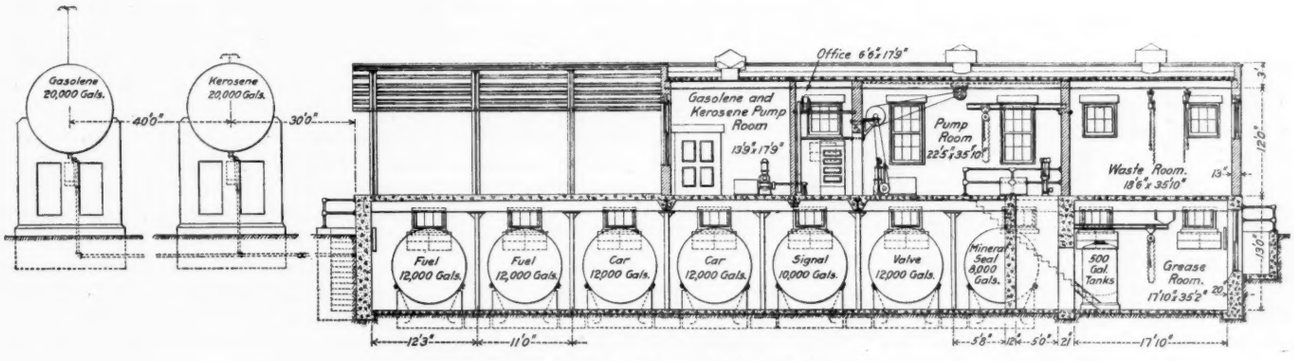
CASTING PLATFORM.

Adjacent to the erecting and machine shop, and separated from the material platform along the north side of the storehouse by track clearance, is a casting platform 518 ft. long by 60 ft. wide. Over this platform is a crane runway with a 10-ton, 59-ft. span girder crane which is arranged to serve the track along the north side of the platform and deliver material to a point underneath, where it may be handled by the yard crane for distribution to all

End Elevation and Sections Through the Storehouse.



Longitudinal Section Through the Storehouse.

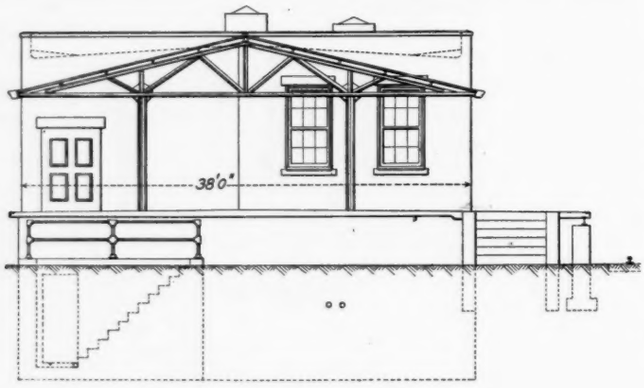


Longitudinal Section Through the Oil House.

shops. This crane is provided with a large magnet for lifting heavy iron and steel pieces.

OIL HOUSE.

West of the erecting shop and storehouse, and at a distance of 220 ft. from both buildings, is the oil house. This structure, which is built entirely of concrete below the platform line, has side walls of brick and a roof of concrete, water-proofed with a 5-ply pitch felt and a gravel covering. Special attention has been given to the fire risk in order to make the building entirely fireproof, and no combustible material has been used in its construction. Tanks for the storage of the various oils with the exception of kerosene and gasolene are located in the basement of the building and under the platform. Kerosene and gasolene are stored outside in two elevated tanks, each having a capacity 20,000 gal. These oils are handled to the storage tanks from the cars by motor-driven power pumps located in a separate compartment on the west side of the building. From the tanks kerosene and gasolene are distributed and barrels are filled by gravity. For handling oils stored in the tanks located in the



End Elevation of the Oil House.

basement and used in considerable quantities five Gilbert & Barker power pumps, each having a capacity of 40 gal. per minute, are provided. Ten Bowser self-measuring pumps are also located in the pump room for handling as many different kinds of oils in small quantities. The power pumps are driven from line shafting run by a 3-h. p. 440-volt Westinghouse alternating current motor. A compartment 18 ft. by 36 ft. is provided for the storage of baled waste. For the easy handling of this material an overhead trolley has been installed.

The entire work of construction is under the direct supervision of F. H. Clark, general superintendent of motive power of the Burlington system, to whom we are indebted for the foregoing details. All engineering work, including the design and construction of buildings, is being handled by Westinghouse, Church, Kerr & Company, working in conjunction with Thomas Roope, superintendent of motive power of the lines west of the Missouri river, and Willard Doud, shop engineer of the Burlington system.

FOREIGN RAILWAY NOTES.

The *Frankfurter Zeitung* reports that China has consented to the plan of constructing a railway from Baikal lake on the Trans-Siberian Railway, through the Gobi desert to Pekin direct. It is believed that Russia will build from Baikal lake to Kiatchka, and that China will complete the remaining 900 miles. When this section has been constructed, the Trans-Siberian Railway will be shortened by over 600 miles.

The federal railways in the State of Bahia, Brazil, have been leased to a syndicate of Paris bankers, and extensions of the lines have been provided for. The Frenchmen secured control of 1,875 miles of railway. The cost of the extensions is estimated at $35,000,000, for which federal bonds will be issued.

CLEANING PASSENGER EQUIPMENT AT TERMINALS.

BY J. H. PITARD.

Master Painter, Mobile & Ohio, Whistler, Ala.

The question of the best and most economical method of cleaning passenger equipment at terminals has seemingly narrowed to the question of the chemical composition and comparative merits of the various cleaning compounds, if we may judge from the expressions of some whose articles appear in the trade journals. Originally, the purpose of terminal cleaning was to maintain passenger equipment in a neat and sanitary condition, but in recent years its scope has greatly broadened, and it has become an auxiliary of the paint department in prolonging the life of paint and varnish, thus extending the term of service of the equipment. Its success, however, in this particular depends largely on the coöperation of the department that builds the car, the department that paints it, the purchasing department that provides the paint, varnish and cleaning compounds, the terminal cleaning department that cleans it, and the transportation department whose disposition of the equipment has an important bearing on its future appearance and durability.

A neatly kept passenger equipment appeals to the stockholder and the traveling public; it is a traveling advertisement for the company, and if properly cleaned, greatly extends the term of service by affording a measure of protection to the paint and varnish. Terminal cleaning is a feature of railway economy which when considered in its various relations to successful railway operation is of greater importance than would appear at first sight, and is second only in importance to the painting department, under whose jurisdiction it rightly belongs. Notwithstanding its importance, however, it is in some instances the most neglected of any of the departments of railway work, the work being intrusted to careless or inexperienced workmen without proper supervision or instruction.

As stated above, successful terminal cleaning involves several departments, first of which are those of design and construction; these should aim to produce a plain surface—a surface free of carvings, sharp corners, ledges or any protuberances that offer a lodging or hiding place for water, dirt and microbes. The car should have a smooth level surface on which a smooth job of painting may be done, as this is essential to proper future cleaning; the smoother the surface, the easier the cleaning. The painting should be done with a view to withstanding the elements and the abrasive effects of cleaning compounds. It should have a good surface and a moderately thick body of varnish in order that the surface may not become threadbare under the effects of repeated terminal cleaning. The varnish should be thoroughly dry before the car is placed in service. If it is exposed to the sun prematurely, it becomes soft and absorbs the dirt, and probably blisters or cracks; perfect cleaning under such conditions is impossible.

Where the selection of paint materials and terminal compounds devolves on the purchasing department, it is a menace to the successful and uninterrupted progress of a terminal cleaning system on account of the lack of practical knowledge of suitable material for the work in question. A poor cleaner will destroy a good varnish, and a good cleaner will sometimes produce unsatisfactory results when used over a poor varnish. Either combination would be unsatisfactory in the matter of maintaining an up-to-date terminal cleaning system. Where such matters come within the scope of the mechanical department, and all materials, both varnishes and cleaners, are subjected to practical tests, and their strong or weak points are demonstrated previous to their adoption, the results should be, and usually are, satisfactory.

Much depends also on the handling or disposition of the equipment by the transportation department after it enters service in order that the regular routine of terminal cleaning may not be interrupted. Passenger cars when not required for immediate service, are occasionally placed on a siding, broadside

to the sun, and thus neglected until the paint and varnish are badly affected by the elements, when they might have had the protection of the car shed. At other times cars are held indefinitely at points on the system where terminal cleaning is not performed, and they are sometimes cleaned at one end of the line with a standard cleaner, and at the opposite end with a cleaner that is an unknown quantity. If injury to the varnish is the result, it is a difficult matter to ascertain which of the cleaners is responsible for it. These are some of the obstacles often met with in terminal cleaning, for which the transportation department is largely responsible, and which might be obviated by an established system of terminal cleaning, supported by the mutual coöperation of all the departments concerned.

Ideal conditions favorable to the terminal cleaning department are perhaps seldom to be found; therefore conditions as they exist govern the operations of this department. No small degree of skill or practical experience is necessary in order that it may be able to adjust itself to varying conditions as they arise, and while no iron-clad rules can be formulated that will exactly fit every case, there are certain rules or customs which may be generally observed to advantage in conducting the work of this department. In addition to maintaining the passenger equipment in a cleanly condition, particular attention should be given to supplementing the work of the painting department, as far as possible, in combatting the effects of the elements on paint and varnish. While oxygen (of which water, H_2O, is partly composed), is essential to organic life, it is destructive to all inorganic substances, and is therefore an enemy to paint and varnish. For this reason water as a cleaning agent of paint and varnish should be avoided as far as conditions will permit. When water is used for this purpose it is simply supplementing the destructive effects of rain to which a pasenger car is constantly exposed while in service. The best cleaners are those that contain no water in their composition, and are most effective in removing dirt and least destructive to paint and varnish; neither should they have affinity for oxygen, nor contain coarse abrasive powder which, while it facilitates the dislodgment of dirt, gradually but surely destroys the varnish.

As to the frequency and best method of applying such cleaners, the conditions of service will determine; cars having a long run, and possibly through tunnels, will require more frequent application than those having a short run and where other conditions are more favorable. But in no case should a cleaner containing abrasive substance be used as long as the surface can be kept presentable by simply wiping with dry waste. During rainy weather a thin film of oil on the surface affords much protection to the varnish. This may be effected by an occasional oiling with the oil contained in the cleaner, minus the abrasive substance, and lightly wiping with cotton waste. It is the custom on some roads to clean the surface every 30 days with an oil cleaner and alternate with water cleaning. This method defeats the object aimed at in adopting an oil cleaner in lieu of water in order to counteract the destructive effects of water on paint and varnish.

In order that terminal cleaning may be made effective, and become an auxiliary of the paint department in extending the life of paint and varnish, and thereby extending the term of service of the equipment, the terminal cleaning department should by all means be placed under the supervision of the paint department, and a practical man, familiar with the nature of paint and varnish, should be at its head. Exhaustive tests of the various cleaners should be made and a record kept for future reference. A regular routine of cleaning should be established and rigidly enforced; its effect on paint and varnish should be closely observed. If the results are not such as to add to the life of the paint and varnish and extend its term of service, it is evidence that improvement of the system is needed and should be made without delay.

The Swedish State Railways have recently put on third-class sleeping cars for the first time.

FOUR-CYLINDER BALANCED SIMPLE LOCOMOTIVES, CHICAGO, ROCK ISLAND AND PACIFIC.*

In November, 1909, two Atlantic type locomotives, having four simple cylinders arranged on the balanced principle and using superheated steam, were placed in passenger service on the Chicago, Rock Island & Pacific. This road had a number of simple engines equipped with superheaters, and also balanced compound locomotives, both of which classes had proved to have important advantages. Economy in fuel and water consumption and increased hauling capacity had resulted from the use of superheated steam; and easier riding qualities and greater ease on track and bridges from the application of the balanced feature. In order, therefore, to secure in one engine the advantages of both classes of locomotives it was decided to combine the important features of each in a four-cylinder balanced simple locomotive using superheated steam.

A comparison of the dynamic wheel loads at high speeds of the design here illustrated with those of an ordinary design of two-cylinder Atlantic type locomotive brings out forcibly the advantage of the balanced engine in its less injurious effect on the track. Assuming a two-cylinder Atlantic type locomotive with driving wheels 79 ins. in diameter and a stroke of piston of 26 ins.; at 85 miles per hour, a vertical disturbance of 22,760 pounds per axle is caused by the excess weight in the counterbalances required to balance the reciprocating parts. A normal axle load of 52,900 is thus increased to 75,660 pounds and decreased to 30,140 pounds with each revolution of the driving wheels, giving an increase of dynamic over static weights of 43 per cent. Considering each driving wheel separately, there is a vertical disturbance of 16,100 pounds; or a normal wheel loading of 26,450 pounds is increased to 42,550 pounds and decreased to 10,350 pounds during each revolution of the driving wheels, a difference of 61 per cent.

Considering the balanced simple locomotive with 73-in. driving wheels and a 26-in. stroke; at 85 miles per hour, the vertical disturbance per axle is only 975 pounds and the normal axle loads of 58,000 pounds are increased to 58,975 and decreased to 57,025 pounds during each revolution, giving a difference of only 1.6 per cent. Taking the individual wheel load of 29,000 pounds, the vertical disturbance is 6,780 pounds, making the maximum 35,780 and the minimum 22,220 pounds, a difference of 23 per cent. of the normal. As the centers of gravity of the equivalent counterbalances for the reciprocating parts of the right and left wheels are 187 degrees apart, they approximately counterbalance each other when each axle is considered as a whole; while the vertical disturbances per wheel are approximately only one-third as great as in the two-cylinder engine.

SERVICE TESTS.

The engines are in service on the Illinois division, between Chicago and Rock Island, a distance of 181.1 miles; and are hauling some of the fastest and most important passenger trains. All the grades are short, and the maximum is only 40 feet to the mile, or 76 per cent.; there are long stretches of practically level track. None of the curves are sharp, the worst being 4 deg 30 min.

As the passenger power on this division includes a number of two-cylinder simple and four-cylinder balanced compound Atlantic type locomotives, exceptional opportunity has been afforded to make comparison between the three classes working under identical conditions with a view to determining the relative cost of operation and maintenance as well as reliability of service. Full advantage of this opportunity has been taken by the Rock Island officials and careful records have been kept to permit of just comparison.

A series of comparative tests, covering a period of two weeks from December 29, 1909, to January 9, 1910, was made to determine the relative coal consumption of the three classes. The

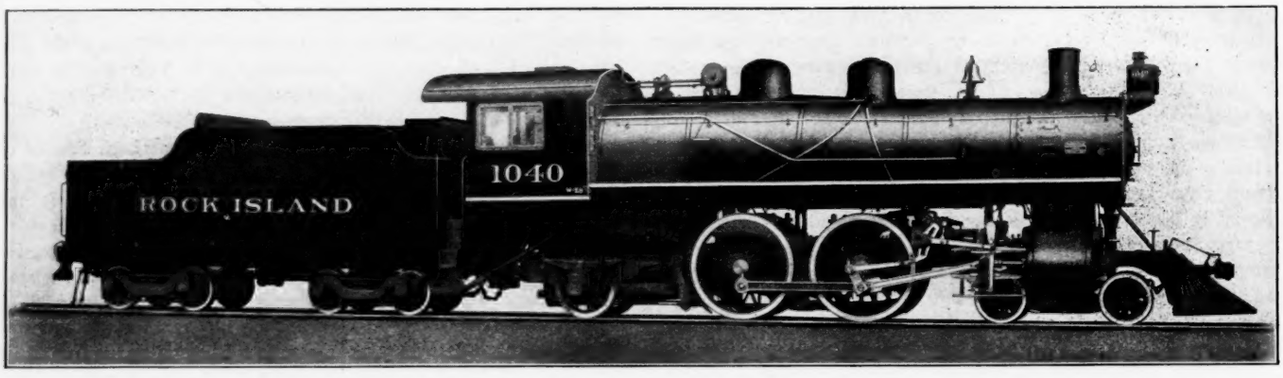
* Abstract of Bulletin No. 1007, American Locomotive Company, New York.

locomotives tested were 1016, a two-cylinder single expansion engine; 1045, a four-cylinder balanced compound engine; and 1041, a four-cylinder balanced simple locomotive. In each case, the tests were made with regular trains, Nos. 7 and 8, west bound and east bound, respectively, between Chicago and Rock Island. The results of six trips for each locomotive, three trips in each direction, were recorded. With the exception of one trip of locomotive 1045, east bound from Rock Island to Chicago, on which the train was composed of eight cars, the train on every trip consisted of seven cars and the tonnage hauled was approximately the same in all the trials. As the tests were conducted during very severe weather, the results obtained represent the performance of each locomotive under the worst conditions, and, consequently, bring out most clearly the relative efficiency with respect to fuel consumption of the three classes.

A summary of the average results of the test is given in the accompanying table, which requires little explanation. It shows that locomotive 1041 used, on the average, 13.3 per cent. less water per trip than the four-cylinder balanced compound, and 11.7 per cent. less than the two-cylinder simple locomotive. Calculated on the basis of the equivalent of water from and at 212 deg. Fahr., the table shows a saving in favor of the four-cylinder balanced simple locomotive with superheater of 13.2 per cent., as compared with locomotive 1045, and 11.8 per cent. as compared with locomotive 1016. On the ton-mile basis, using the tonnage behind the tender or the paying load, there is a difference in favor of the same engine of 12.4 and 12.6 per cent. water, as compared, respectively, with the single expansion and compound engines.

The results also indicate considerable economy in fuel consumption for the superheater locomotive; on the paying ton-mile basis the saving was 6.7 per cent. over the balanced compound and 16.9 per cent. over the two-cylinder locomotive. There was little difference in the average quality of the coal used on the three locomotives, though that given to locomotive 1041 was a little lower in percentage of combustible material than the coal used by its competitors.

Although a comparison of the average results of all the tests probably indicates truly the advantages of the four-cylinder balanced simple superheater locomotive under actual operating conditions, possibly more accurate conclusions as to the efficiency of the three designs could have been drawn, had the same crew



Four-Cylinder Balanced Simple Atlantic Type Locomotive with Superheater; Chicago, Rock Island & Pacific.

COMPARATIVE TEST, SHOWING RELATIVE FUEL CONSUMPTION OF A 2-CYLINDER SIMPLE, A 4-CYLINDER BALANCED COMPOUND AND A 4-CYLINDER BALANCED SIMPLE SUPERHEATER LOCOMOTIVE.

DECEMBER 29, 1909, TO JANUARY 9, 1910.

	Summary. Total Average of Tests.			Saving in per cent. of Locomotive 1041 over	
Engine	1016	1045	1041	1016	1045
Type	4-4-2, 2-cyl. Simple.	4-4-2, 4-cyl. Bal. Comp.	4-4-2, 4-cyl. Bal. Simple Superheater.	....	....
Total weight (pounds)	180,000	199,400	202,000	....	....
Weight on driving wheels (pounds)	102,000	105,540	116,000	....	....
Total square feet of heating surface	2,825.5	3,209	2,715	....	....
Total square feet of grate area	44.86	50.40	42.8	....	....
Working pressure (pounds per square inch)	185	210	170	....	....
Cylinders (diameter and stroke)	21 in. x 26 in.	15 & 25 in. x 26 in.	17½ & 17½ in. x 26 in.	....	....
Tractive effort (pounds)	24,700	22,500	29,600	....	....
Mileage since No. 1 or 2 repairs	24,623	34,324	12,680	....	....
Distance between terminals	181.1	181.1	181.1	....	....
Total time taken between terminals	5H. 5M. 56S.	5H. 7M.	5H. 58M. 45S.	....	....
Actual running time between terminals	4H. 32M. 20S.	4H. 46M. 36S.	4H. 34M. 13S.	....	....
Number of stops	6.33	7.15	14.6	....	....
Miles per hour (based on actual running time)	39.96	37.98	39.63	....	....
Number of cars in train	7	7.165	7	....	....
Weight of cars (pounds)	802,480	812,851	808,114	....	....
Average temperature of feed water (degrees Fahr.)	42.3	42.18	42.16	....	....
Average steam pressure by gage (pounds per square inch)	177.3	195.4	170.5	....	....
Total weight of water fed to boiler per trip (pounds)	112,818.7	114,264	99,563.9	11.7	13.3
Total weight of water fed to boiler per hour (pounds)	22,120	22,324	16,650	....	....
Factor of evaporation	1.2293	1.2317	1.2283	....	....
Equivalent water fed to boiler from and at 212 deg. (pounds)	138,694	140,738	122,294	11.8	13.2
*Equivalent water fed to boiler from and at 212 deg. per ton-mile (pounds)	1.907	1.911	1.670	12.4	12.6
Equivalent water fed to boiler from and at 212 deg. per lb. of coal used (pounds)	6.65	7.47	7.00	....	....
Equivalent water fed to boiler from and at 212 deg. per lb. of dry coal used (pounds)	7.07	7.77	7.47	....	....
Per cent. of moisture in coal	5.95	3.91	6.28	....	....
Per cent. of combustible in coal	84.47	84.36	83.81	....	....
Weight of coal as used (pounds)	20,852	18,832	17,465.8	16.2	7.2
*Weight of coal as used per ton-mile (pounds)	.2868	.2557	.2385	16.9	6.7
Weight of dry coal as used (pounds)	19,612	18,095	16,369	16.5	9.5
*Weight of dry coal as used per ton-mile (pounds)	.2696	.2456	.2236	17.1	9.0
Weight of combustible as used (pounds)	17,613	15,886	14,638	16.9	7.75
Weight of combustible as used per ton-mile (pounds)	.2422	.2157	.1999	17.5	7.3

NOTE.—Test made during severe weather with a range of temperature from 2.5 deg. F. to 36.5 deg. F., including heavy storms and numerous delays; water measured by gage stick through manhole and coal by actual weight.

*Based on tonnage behind tender, or paying load.

run the engine on all the tests, thereby eliminating the factor of efficiency of the engineer and fireman. The best runs from the standpoint of fuel consumption of both locomotive 1045 and 1041 were made with the same crew. Between these two runs there was a difference of 18.4 per cent. in favor of locomotive 1041 in the amount of coal consumed per paying ton-mile; while in the equivalent amount of water fed to the boiler from and at 212 deg. per paying ton-mile there was a saving of practically 14 per cent.

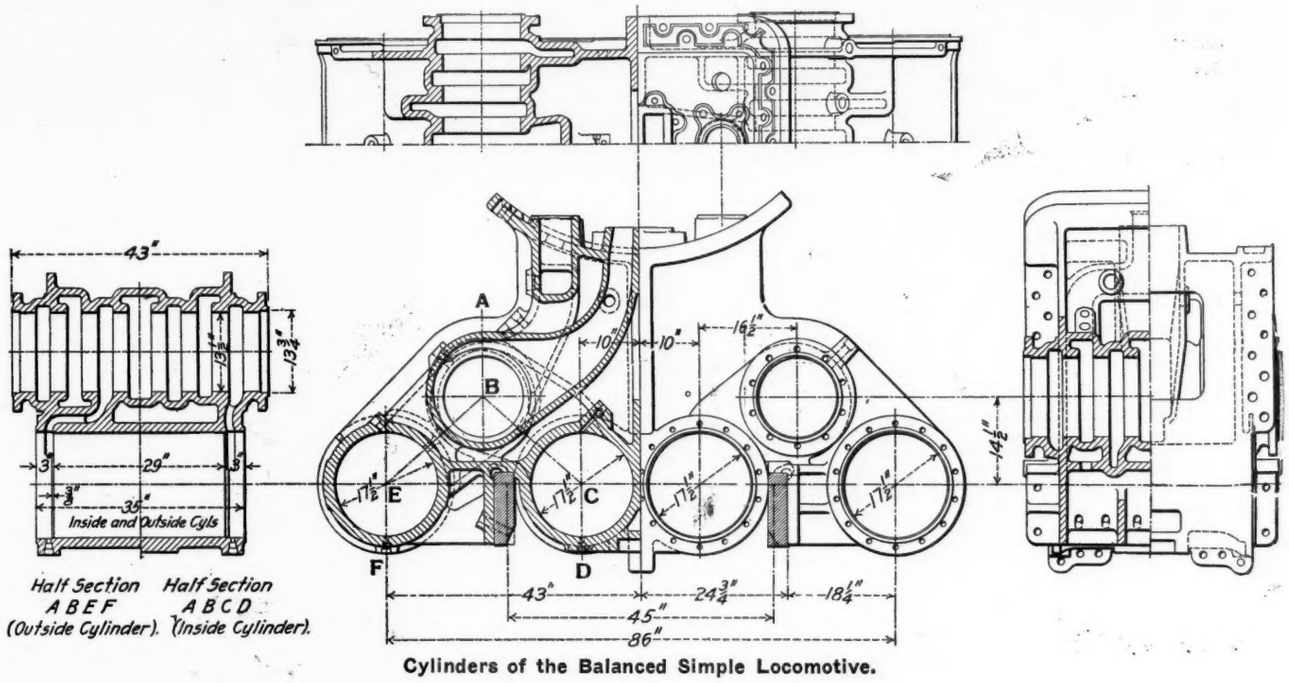
Comparison of the records of the cost of maintenance of the balanced simple locomotive with similar records covering the same period for the balanced compound and two-cylinder simple Atlantic type locomotives running on the same division shows that in the principal items of cost, outside of fuel and wages of the crew, such as running repairs, handling at roundhouse and lubrication, the expense per engine mile is practically the same for all three classes of locomotives. In the item of the cost of fuel the tests constitute convincing proof of the greater efficiency of the four-cylinder balanced superheater locomotive as compared with the two other classes.

sense exceptional for this class of locomotive, but are typical of their daily performance. The four-cylinder balanced simple Atlantic type locomotive has no difficulty in making practically the same schedule as the four-cylinder balanced compound and the two-cylinder simple Atlantic type locomotives with one and two more cars and two and six more stops respectively. The satisfactory performance of these locomotives viewed from every standpoint proves the merits of the characteristic features of the design, which are equally applicable to heavier classes of power adapted to meet the requirements of the most severe passenger service.

DESIGN.

The design, which was prepared by the American Locomotive Company, was carefully worked out with reference to the particular conditions of the service for which the engines were intended. Every detail was given close attention, and in its special features the design throughout follows the best precedents of European as well as American locomotive practice.

As will be seen from the illustrations, the four cylinders are arranged in accordance with the practice followed in the well-



Cylinders of the Balanced Simple Locomotive.

The comparative train record of these locomotives is equally as good as their fuel record. Each of the two locomotives has made a number of runs of particular merit and worthy of note because of fast speeds maintained. On June 30, 1910, locomotive 1040, with train No. 25, composed of five cars of an aggregate weight of 341.3 tons, made up 21 minutes in running from Bureau to Rock Island, a distance of 67 miles. That is, it cut down the regular schedule time by about 20 seconds per mile. The average speed on this run, including one stop, was 58.2 miles per hour. The 22.5 miles between Sheffield and Geneva were made in 19 minutes, or at an average speed of 71.3 miles per hour. The engineer driving the locomotive on this occasion stated that it was necessary to keep it eased off across the prairies, and that he had never in his long service seen a locomotive that could run so fast and do it so easily.

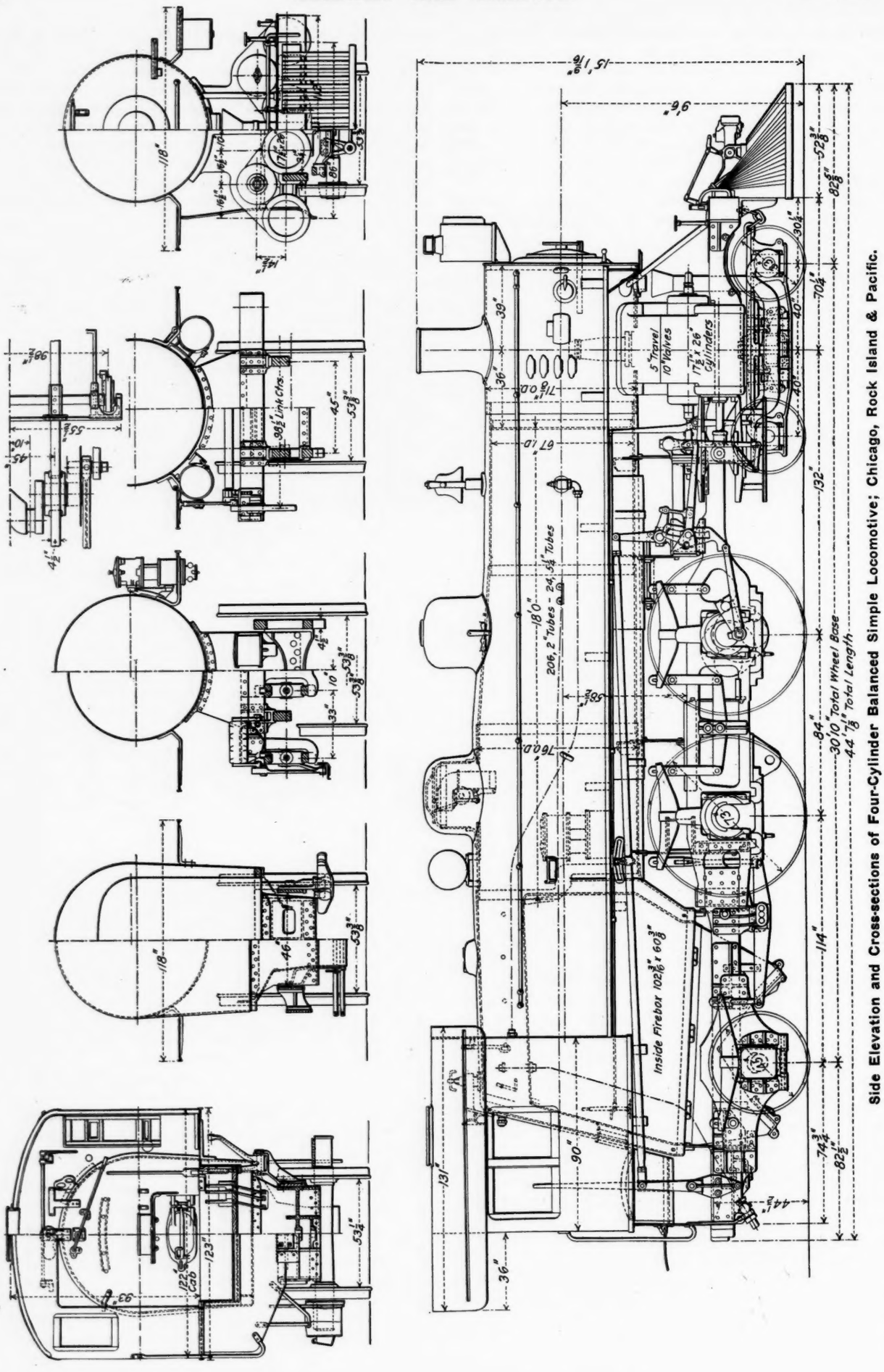
On March 23, 1910, locomotive 1041 made a notable trip with train No. 26, east bound, from Rock Island to Chicago, a distance of 181.1 miles. The train consisted of six cars, having an aggregate weight of 329 tons. Including six regular stops aggregating 38 minutes, the average speed maintained was 40.84 miles per hour. The highest speed attained on this trip was 56.75 miles per hour.

Though the two runs cited are noteworthy, they are in no

known Von Borries balanced compound locomotive, all being set in the same transverse and horizontal planes. In order to obtain a satisfactory length of 84 ins. for the main rod, the cylinders are placed about 3 ft. further ahead of the front driving wheels than is the usual practice in locomotives of the 4-4-2 type of wheel arrangement. This change in the normal position of the cylinders was accomplished, however, with an increase of only 2 ft. in the length of the tubes.

The cylinders are in two castings, each with a half saddle. Each casting contains an inside and outside cylinder, with a common steam chest placed above and between them. All four cylinders are connected to the front pair of driving wheels, the main rods of the inside cylinders being connected to the cranked axle of those wheels.

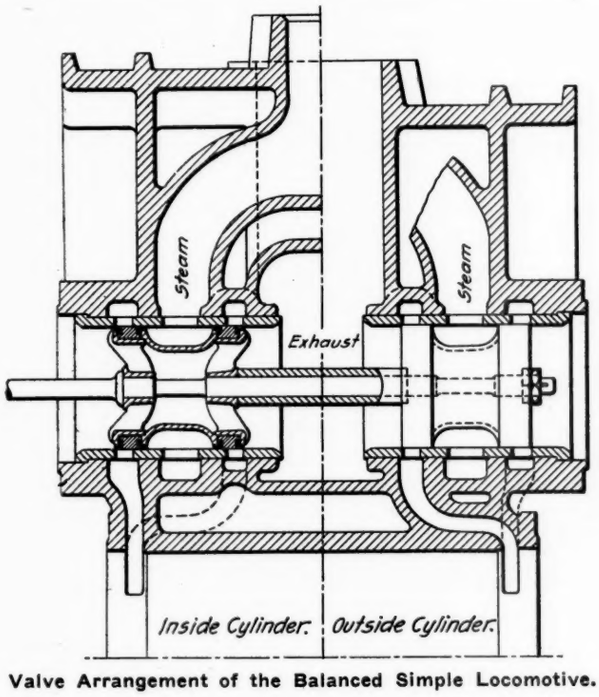
An efficient and simple valve motion, which involves no complications in the cylinder construction, is employed, and is shown in one of the illustrations. The two cylinders on each side are served by two 10-in. hollow piston valves mounted on a single stem and actuated by a simple arrangement of the Walschaert valve gear. Superheated steam is conveyed to the center of the portion of the common steam chest which each valve occupies by branches of the cored steam passage, which divides at a point a short distance from its connection with the steam pipe. The



Side Elevation and Cross-sections of Four-Cylinder Balanced Simple Locomotive; Chicago, Rock Island & Pacific.

inner ends of the two valves distribute the steam to the outside cylinder and the outer ends serve the inside cylinder. With this arrangement, the necessary admission of steam simultaneously to opposite ends of the two cylinders is secured without resort to crossed steam passages, or other complications of the cylinder construction, and with a simple design of valve having a minimum number of packing rings to keep in repair. The valve stem packing is subject only to exhaust pressure. As the effect of this arrangement is equivalent to that of an outside and inside admission valve for the outer and inner cylinder, respectively, the valve gear connected to the crosshead of the outside cylinder is accordingly arranged for an outside admission valve. The piston valve, which is of special design for use with superheated steam, is shown in one of the illustrations.

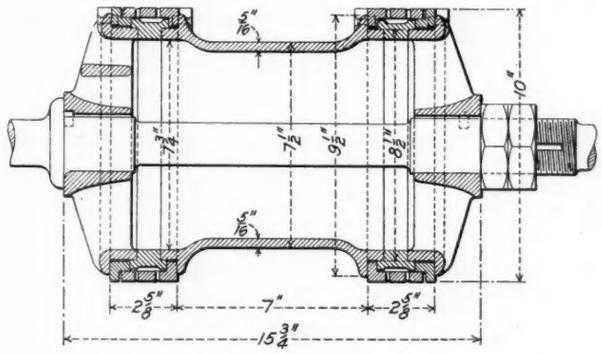
The Walschaert valve gear is a simple, compact and satisfactory design for this type of gear. The link is carried in a cast steel bracket bolted to the front of the yoke or cross tie, located a little ahead of the front driving wheels. A longitudinal bearer extending between this cross tie and the guide yoke furnishes support for the bearings of the reverse shaft, the forward extending arm of which is connected by means of a link to the radius bar. As the center line of the steam chest is 22¾ in. inside the vertical center of the link, a rocker arm is used to transmit the motion of the link to the valve. This rocker arm is carried in a bearing secured to the guide yoke, and its outer arm has a pin connection with the upper end of the combination lever. The inside arm of the rocker shaft is connected to the valve rod through the medium of a block, which works in a yoke in the



Valve Arrangement of the Balanced Simple Locomotive.

rod, the rear end of the valve rod being extended to slide in a guide bolted to the back of the guide yoke. An offset of ⅝ in. is made in the upper end of the combination lever in order to neutralize the effect of the angularity of the main rods on the valve events and secure as nearly equal cut-offs as it is possible to obtain in two cylinders connected at 180 degs. to each other and operated by two valves deriving their motion from a single valve gear.

The superheater is of the fire tube type with side headers. The frames on each side consist of a main frame of cast steel 4½ in. wide with a single front rail 3¼ in. in width cast integral with it, and a slabbed rear section spliced to the main frame immediately back of the rear driving wheel. There is also an outside supplementary frame which carries the trailing journal box and is connected to the inside frame through the medium of heavy steel spacing castings. A strong and substantial system of frame bracing is employed. All the cross ties are of cast steel and have ample bearing on the frames. In addition to the foot plate at the rear of the frames, there is a cross tie between them just ahead of the front end of the firebox; another back of the rear pedestals; one between the front and rear driving wheels, having a bearing of 41½ in. on the upper rails of the frames, and



Piston Valve of the Balanced Simple Locomotive.

one spanning the lower rails of the frames immediately back of the leading pedestals. The frames are further braced together by the cross tie ahead of the front driving wheels, which furnishes the support to the link bracket, and by the heavy guide yoke. The boiler is braced to the frames at all of these points by steel plates. The general dimensions and data are as follows:

General Data.	
Type	4-4-2
Fuel	Bit. coal
Tractive power	29,600 lbs.
Weight in working order	202,000 lbs.
Weight on drivers	116,000 lbs.
Weight on leading truck	49,000 lbs.
Weight on trailing truck	37,000 lbs.
Weight of engine and tender in working order	351,900 lbs.
Wheel base, driving	7 ft. 0 in.
Wheel base, total	30 ft. 10 in.
Wheel base, engine and tender	62 ft. 8 in.
Cylinders.	
Kind	Bal. simple
Diameter	17½ in.
Stroke of piston	26 in.
Valves.	
Kind	Piston
Diameter	10 in.
Travel	5 in.
Wheels.	
Driving, diameter over tire	73 in.
Driving, journals	11 x 11 in.
Engine truck, diameter	33 in.
Engine truck, journals	6 x 12 in.
Trailing truck, diameter	45 in.
Trailing truck, journals	8 x 14 in.
Boiler.	
Working pressure	170 lbs.
Outside diameter of first ring	68⅛ in.
Firebox, width and length	60¼ x 102 3/16 in.
Tubes, number and diameter	206, 2 in., and 24, 5¼ in.
Tubes, length	18 ft.
Heating surface, tubes	2,521 sq. ft.
Heating surface, firebox	194.5 sq. ft.
Heating surface, total	2,715.5 sq. ft.
Heating surface, superheater	479 sq. ft.
Grate area	42.8 sq. ft.
Center boiler above rail	9 ft. 6 in.
Top of smokestack above rail	15 ft. 1 9/16 in.
Tender.	
Frame	Cast steel
Wheels, diameter	33 in.
Journals	5½ x 10 in.
Water capacity	7,500 gal.
Coal capacity	13 tons

A line of railway is being constructed in Brazil at a cost of $7,738,000, from Oruro, on the Antofagasta-Oruro-La Paz line, to Cochamba, which will tap a region rich in agricultural produce, and which only requires improved means of transport to develop great industries. The first 32 miles of this line will be opened for traffic shortly.

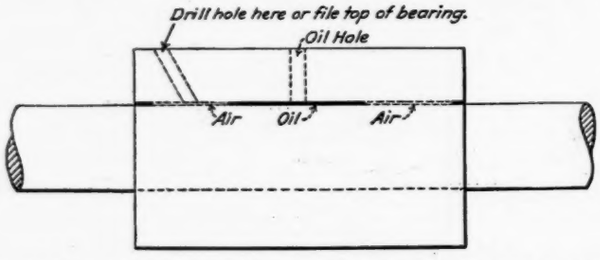
Care and Selection of Shop Equipment.

SELECTION AND USE OF MACHINE TOOLS.

BY W. P. SPADE.
Corning, N. Y.

Improvements in Turret Lathe Construction.—In the brass room a large number of jobs of threading and box tool forming are now being done with tool post tools. Why? Because we do not have a turret lathe catalogued by a single tool manufacturer in this country on which the turret will swing a 12-in. collapsible head or box tool holder over the turret slide, I have reference to a head such as made by the Geometric Tool Company; as near as memory serves me one of its 11 in. outside diameter heads will cut up to about 5 in. diameter. After being called on to write the specifications for a tool equipment for a large concern I took this question up with a manufacturer's agent and had a 20-in. Monitor lathe raised so that the turret would swing a 12-in. head over the turret slide. It greatly increased the value of the lathe with a small increase in cost.

Lubrication.—Gear box drives that make possible a quick change of speeds are used extensively. This type of drive requires several more bearings than the cone drive and since, as a rule, they fit very close there is room for but a light film of oil, and the oil grooves are often too small. On starting a new machine I keep it well lubricated with the hope that none of the bearings will stick, but there is usually some trouble. I immediately tear the machine down and enlarge the oil holes and grooves for the following reason: The shaft is a neat fit in the bearing with only .001 in. or .002 in. clearance. The oil flows only a short distance either side of the oil hole and is prevented from going further by the air which is compressed ahead of it and which can not escape because of the thin film



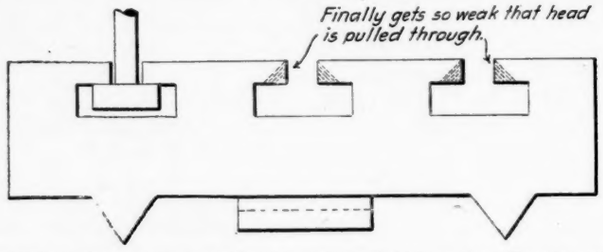
Illustrating Lack of Lubrication of Journals and How it May be Remedied.

of oil or grease which was placed on the shaft in fitting up. As a result the shaft is cut at each end of the bearing. To overcome this, drill a small hole through the bearing near each end as shown on the sketch, or file a small groove in the bearing near the ends.

Have Driving Wheel Lathe Suitable for Trailing Wheels.—Don't neglect in selecting the next driving wheel lathe to have the distance between the centers sufficient to take in trailer wheels—the ones that have the outside bearings. Some shops are having considerable extra expense turning tires on these wheels, because the lathe in use will not handle them. Even if you do not have any of these engines on your road now you may in the future and the extra expense for a properly equipped lathe is small.

Abuse of T Slots in Planer Platens.—I have seen a number of planer platens ruined in a few years' service from a simple cause due to pure carelessness. Most manufacturers make the T slots considerably larger than the standard square head bolt. The foreman instead of having a special bolt made uses standard bolts. The small heads gradually wear off the metal, as shown on the sketch, until they pull through the slot. The same thing is true of vertical boring mill tables. I have seen three planer platens ruined in one shop from this cause.

Worn Bushings.—Carelessness in renewing worn bushings in machine tools is expensive. I have seen many dollars' worth of gearing worn and broken because of the shaft having a large



Showing How the T-Slots on Planer Platens Are Destroyed.

amount of loss motion. The gears tend to work on the points of their teeth and break.

Sensitive Drills.—I have never seen a locomotive repair shop with too many sensitive drills, and I have seen some large shops that did not even have one. Get three or four of these and see how they turn the work out and keep down drill breakage.

Engine Lathe Ways.—A couple of tool makers still build lathes in which the tailstock is guided by right angle ways. In recommending lathes be careful to specify a V guided tailstock, as with the V guides all wear is automatically taken up and the centers remain in alinement.

THE CARE AND SELECTION OF MACHINE TOOLS AND SHOP EQUIPMENT.

BY JOHN V. LE COMPTE.
Foreman, Baltimore & Ohio, Garret, Ind.

Selecting Machine Tools.—Great care should be exercised in the selection of machine tools. Many good machines are on the market today for which splendid results are claimed if given a fair trial; therefore, machine specialists should be selected to purchase machinery who thoroughly understand the needs for which the machines are required and who are competent to select the best machines on the market for these needs. Experience has taught that to purchase a machine nearly meeting the requirements for a few dollars less on the day of purchasing, yet not meeting the requirements as a whole, is exceedingly expensive in its failure to produce the results desired. The power to be transmitted, as well as the speed required, should be given careful consideration. The installing of the machinery in the shop so that the work performed can be handled most effectively is an important factor. If the line of work to be performed is heavy, the machine should be installed within reach of the crane, or be in position to utilize an air or electrical lift in part with other machines.

Arranging Machine Tools.—Modern practice of installing machines of like kind in near proximity has proven effective in handling and performing work, as the material to be machined by a line of machines can be delivered to the section of shop where they are installed, often saving a second handling. This practice has not only proven true in reference to lathes, boring mills, slotters, milling machines, planers, etc., but also with drill presses.

Drill Presses and Drill Grinders.—The up-to-date drill press, built for high speed, must have a plentiful supply of work delivered to a point near at hand. Drill presses installed near each other can supply the various demands made upon them with quick despatch when all classes of work performed by them are delivered to a convenient point from which the operators may

draw as occasion demands without the loss of time. Drill presses with two, three or a larger number of spindles can be used effectively on many lines of work, but such presses without a lateral motion are badly handicapped; especially is this true in drilling and fitting up eccentrics and eccentric straps, as machines with four spindles with lateral motion can be used effectively on them. A drill grinder should also be installed, as the operators of the drill presses cannot afford to lose time from operating their machines if effective results are to be accomplished and the machines kept in constant operation. This grinder should be installed near the drill presses and a competent operator put in charge. He should be supplied with a drill cupboard to contain all sizes of drills desired so the grinder can immediately supply the demands of the drill press operators without loss of time. The operator of the grinder should be held responsible for the drills.

Tool Grinder.—What the drill press grinder accomplishes for the effective output of the drill press, the tool grinder can accomplish for the shop at large. This machine is indispensable in an up-to-date machine shop. If one machine tool grinder can supply the shop, it should be located near the center of the shop and should be in charge of a competent man, who thoroughly understands the correct way in which the different tools should be ground. He should have a sufficient stock on hand, ground, ready to be delivered to the various machine operators. All special tools used on the various machines should be placed in charge of this operator and an enclosure should be built around the machine containing shelves upon which the stock of tools, after having been ground, may be placed awaiting demands thereon. All tools, with the exception of possibly two or three used by an operator on a continuous job of like work should be kept in this room, thus saving the extra expense of having a large stock of high speed tools scattered about the shop at the various machines.

Dressing Tools.—Another saving feature is the manner of handling tools when they are in need of dressing. They should be taken once a day, by a helper appointed to this task, to the tool dresser. When dressed they should be delivered to the grinding room, where they are immediately ground and placed in stock, eliminating any necessity upon the part of any machine operator of sending a helper with possibly one tool from one department to another.

Check System.—The grinding room, as well as the drill press cupboard, tool room, blue print room, etc., should be operated by the check system. Every machine operator should be supplied with a given number of checks, the same number appearing on them as is used by the operator in reporting for work. These checks are used in securing drills, machine tools, blue prints, etc., as demands require. A record is kept at the office of the number of checks given each employee, and he is held responsible for them.

Air Leaks.—All connections, both by pipe, hose, etc., for transmitting air, should be inspected daily to detect any loss of air because of leaky hose, valves or joints in pipes. This duty may be coupled with that of the shop oiler, whose chief duty is to lubricate all shafts, as well as to report bearings running hot or pulleys slipping which he may be unable to adjust or repair.

General.—No economy can be found in purchasing a cheap grade of high speed steel, having a cold shop in winter, or failure to supply the department with a sufficient number of helpers to keep the shop clean or help the operators on the various machines when their services are needed. While care in the selecting of machine tools is important and up-to-date shop equipment is an absolute necessity, yet to produce the quantity of work consistent with good workmanship is a more serious problem. A system must be established, and to this end a competent foreman with an able corps of assistants must be appointed who are thorough mechanics and who know what machines can accomplish the best results on different kinds of work. The range of work that can be done on the turret lathe is broader than ever, and such work can be performed more cheaply than on any other machine. The vertical turret boring mills, as well as those not having a turret, are to-day supplanting the lathes in nearly every line, except work between centres. The slab milling machine in its line of work is supplanting the planer, as the time required in milling some classes of work is only about 50 per cent. of that required by the planer. The above are only a few of the many advantages to be gained if a progressive up-to-date foreman is in charge and a good system is installed.

CARE AND SELECTION OF MACHINE TOOLS AND SHOP EQUIPMENT.

BY W. H. SNYDER.

Assistant General Foreman, New York, Susquehanna & Western, Stroudsburg, Pa.

The care and selection of shop tools is a most important factor in any shop; without the proper tools much valuable time is often wasted in studying and scheming how a job can best be done. The tools used in the average boiler shop, as a rule, show very hard treatment and in many cases the cause of this is misuse. With a little more care on the part of the men the condition and appearance of the tools would be much better. Take, for example, the power punch in a shop where they do not have a regular operator for doing all the punching. You will often see men try to force a 13/16 in. punch through a ¾ in. die; in punching half holes punches and dies may be saved by using a piece of iron the same thickness and holding it against the piece that is being punched. By so doing you actually punch a full hole and it is much easier on the punch and die. One man should be detailed to do all the punching and shearing. By so doing the cost of maintenance of the punch and dies will be reduced to a minimum.

CARE OF PNEUMATIC TOOLS.

The use of pneumatic tools should receive the most careful attention of all workmen, and especially of the foreman directly in charge. An air hammer should never be put in service without first being well oiled with a good grade of suitable oil; if it continues in service it should be oiled every two hours without fail. Pneumatic tools are like a human being; without the proper nourishment and care they will very soon be a total wreck and useless for service. Never connect an air hose to an air hammer or motor without first blowing the hose out well. There is nothing that will ruin a pneumatic tool quicker than the dirt or grit that is liable to collect in an air hose. At our shop all pneumatic tools have to be delivered to the tool room every evening before the men go home; the hammers are put in a tank containing equal parts of signal oil and kerosene. This keeps them well oiled and prevents them from gumming up. In giving the tools out in the morning the hammers are drained out and given a good oiling with pneumatic tool oil. The motors are also well oiled before they are handed out.

CARE OF MACHINERY.

When installing machines see that they are put on a good foundation, regardless of the size of machine. Level up each machine carefully. The countershaft should not be overlooked; if it is not properly put up, squared, leveled and lined up you will have no end of trouble with the belts. Always keep the machine tools clean and the oil holes open. All revolving parts should be well oiled at all times. Too little attention seems to be given to this important matter.

Never hammer any part of a machine. Never lay anything on the shears or ways. Keep the machine looking neat, as if it was your own personal property. By observing the few points here laid down you will bring credit to yourself and your foreman and keep the cost of machinery and tools to minimum.

CARE AND TREATMENT OF BELTING.

Belts are expensive, and with improper treatment can soon be ruined. Lacing belts with the ordinary rawhide lace seems to receive little consideration. In most of the shops every man has

his own way of lacing and some belts are sure to receive improper treatment, especially those running on cone pulleys. There should be one man in every shop detailed to do all the belt lacing. The lacing giving the best results should be adopted as a standard. The shifting of a cone belt from one cone to another, if the proper care is not exercised, will soon stretch the belt out of shape and it will have a tendency to creep on the next cone. When it is desired to change the speed of the lathe be careful to have the belt next to the cone it is to be shifted on. If you fail to do this you will soon have the belt stretched on one side and it will have a tendency to creep. If the creeping is not stopped the belt will soon be ruined. When you notice a belt commencing to creep on the next cone turn it over or turn it end for end. This will oftentimes save it. Never use rosin or any kind of belt dressing that will hang to the pulley or that will have a tendency to collect on the side of a pulley.

SELECTING TOOLS.

In selecting tools and machinery every foreman should be on the lookout for tools and devices that will assist in increasing the output. The foreman must be in position to give satisfactory reasons showing and proving to his employer that the additional equipment and investment will be a paying proposition.

CARE AND SELECTION OF MACHINE TOOLS AND SHOP EQUIPMENT.

BY JOHN M. HAMM.

Machine Foreman, Lehigh Valley, Sayre, Pa.

It is a question as to which is the more severe handicap to a shop—a poor system of doing the work, or machinery that will not allow the maximum output of high speed steel. In making a tour of the railway shops throughout the country, it was found that in many places the machinery was secured from machine tool builders who gave the transportation department the most freight business, regardless of the efficiency of the machinery.

Foremen Should Visit Other Shops.—It is the practice of some shop managements to send their foremen to visit different shops, thus keeping them in touch with new shop kinks and machine tools, especially those advertised in mechanical papers, thereby educating their forces to all changes that take place in railway shop practice.

Class of Machine Tools.—In order to get the maximum output it is absolutely necessary to get the most powerful, simple to operate, belt driven machines that are on the market. It does not pay to hold a part of an $18,000 engine on an old machine for five hours, where it could have been done on a modern machine in two hours, as the length of time required to repair an engine determines the number of engines required by a railway company.

Soliciting Information.—Many foremen have adopted the practice of soliciting information in regard to shop practice or machine tools from every mechanical man with whom they come in contact, thereby obtaining a vast amount of valuable information.

New Tools to be Purchased.—When it has been decided to secure a new tool of a certain kind, it is customary in many shops for the shop superintendent to ascertain the opinion of his general foreman and foremen before deciding on the make of machine to be purchased, in order to secure the best machine possible.

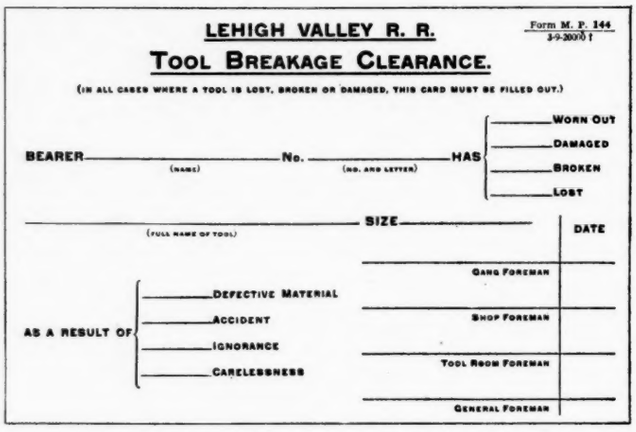
Supply of High Speed Steel.—An important question is the care and supply of high speed steel. The most common method is to have a letter or number for every shape and size required in the shop, and a reasonable supply of every kind kept in a rack designed for the purpose and located in the tool room, thus permitting a machine operator to go to the tool room and secure any kind of tool desired without delay. This method eliminates the old practice of having a number of tools of a kind at every machine to avoid tool-dressing delays, and also of having a large amount of money tied up in high speed steel.

Cleaning & Oiling Machines.—In order to avoid large repair charges, it is essential to keep all bearings properly lubricated; all pipes and oil holes should be cleaned occasionally with kerosene, so that oil may be properly received by the bearings.

Care of Bolt Slots.—Bolt-heads that do not fit the slots are very injurious to the platens of planers and the tables of slotters and boring mills—more so than one would imagine who was not in daily contact with this condition.

Belting.—All belting should be under the supervision of one man. In small shops it is customary for him to oil line and counter-shafting and perform all belt work. His duties require that all belts are to be changed about until not a place can be found where a worn-out belt cannot be used advantageously.

Plenty of Hand Tools.—It is a mistake to deny mechanics hand tools that are required in their work. Using wrenches that do not fit and having men about the shop borrowing from their


LEHIGH VALLEY R. R.

Form M. P. 144

TOOL BREAKAGE CLEARANCE.

(IN ALL CASES WHERE A TOOL IS LOST, BROKEN OR DAMAGED, THIS CARD MUST BE FILLED OUT.)

BEARER _____ (NAME) No. _____ (NO. AND LETTER) HAS ____ WORN OUT ____ DAMAGED ____ BROKEN ____ LOST

_____ (FULL NAME OF TOOL) SIZE _____ DATE

AS A RESULT OF ____ DEFECTIVE MATERIAL ____ ACCIDENT ____ IGNORANCE ____ CARELESSNESS

GANG FOREMAN

SHOP FOREMAN

TOOL ROOM FOREMAN

GENERAL FOREMAN

Tool Breakage Clearance Card, Lehigh Valley.

fellow-workmen, is a serious handicap to the output, as men cannot be expected to make schedule time on a job unless they have the tools.

Care of Small Tools.—The method of giving every employee a certain number of checks to secure tools of all kinds from the tool room is most satisfactory, inasmuch as checks are demanded before the tools are disbursed. It is practically impossible for a man to damage or lose a tool without the tool room foreman knowing of it through the medium of the checks. In order to preserve discipline and have every foreman know how the tools are used or abused, it has been found advantageous to have a foreman make out a clearance card for damaged tools as shown in the illustration.

CARE OF TOOLS AND MACHINERY.

BY WILLIAM G. REYER.

General Foreman, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

The care of tools and machinery in a railway machine shop is a trying proposition. Lots of the machinery now in use was not built for the use of high speed steel. The result is that nearly every shop has a large amount of equipment which should be sold as scrap. Today the tool or machine is forced to the limit with little regard for the machine itself. It is not, will your cutting tool stand, but is the machinery strong enough? Many machine tools over five years of age have to be strengthened to do the required work, and the foreman finds a majority of his tools too weak or the belts too light to keep up with what is expected of them. The rush of today seems to bring the apprentices up to overlook the proper care of shop tools; very few of them seem to realize that taps, dies, reamers, air drills and small twist drills are expensive. Their idea seems to be that it is all right if they break these tools, "the foreman told me to push this work and I could not help it." The trouble is they do not think.

You will find about half of the work turned out will not stand inspection if the foreman is not continually on the lookout. Let the operator understand you want the work pushed, but at the same time demand a proper fit and workmanlike finish. High-speed steel is expensive and the operator should be instructed not to throw it away when it is worn too short for him to use, but should turn it over to the foreman, who will find it can be worked over to advantage. The foreman should see that the proper shape tool is used on all new classes of work; also work out any handy jig to shorten the time of operation. Should the operator suggest a certain style of tool, clamp or jig, listen to him and in many cases you will find it will be to the company's interest to try his suggestions.

Use as heavy cutting steel as the machine will take; it will carry off the heat and allow heavier cuts with a coarser feed. I would recommend the solid tool instead of the use of the tool holder. See that each operator has his own tools, blocks, bolts, clamps and wrenches—this is very important. He should not have to wait for anything. Always have a job ready for him to go on; do not wait for him to come to you.

If any of the machine tools need attention, do not wait or say, "I can't spare it now." Remember, a stitch in time saves nine. The tool room is one of the most important departments in a railway shop. Of all departments, it should have a wideawake, up-to-date foreman; here is where your shop tools should be taken care of. By shop tools, I mean taps, dies, reamers, cutters, punches and such like. The foreman should be able to design and make any special tool required. I make it a practice to keep in close touch with my tool room foreman and it has repaid me in lots of handy and valuable tools. To illustrate—we were experiencing lots of trouble in getting air-pump cylinders bored to the proper smoothness and correct finish. The machine we were doing the work on was worn and I was being repeatedly advised that the work was not satisfactory. Pumps were reported running hot because of badly bored out air cylinders. I explained to the tool room foreman and told him to get up a reamer to do the work. He made one, with inserted teeth, the shank of which fits in the boring mill. It is doing splendid work and the air brake department is now satisfied. This is only one of a great number of handy and useful tools he has devised.

Another department that is very useful and important is the machine repair gang; this is another place where an up-to-date and resourceful foreman is needed. Very often a machine will break down or the parts wear out just at the time when it is needed most. Your repair man must be able to devise a quick and at the same time a durable way to repair the machine. He should see that all shafting, countershafting and pulleys are kept properly tightened; this will prevent a lot of trouble. See that all your machinery is on concrete foundations; this is a benefit for both motor and belt driven machines.

I would recommend the more general use of boring mills, turret lathes and slotters. All such work as cylinder packing rings, piston heads, strap rod brasses, eccentrics and eccentric straps are more economically done on the boring mill than on the lathe. Another labor saver is the taper bolt-turning machine. We turn bolts on this machine and keep them in stock; when bolts are needed they are taken from stock and the holes are reamed to suit. We carry bolts in all sizes and lengths and have only to true out the hole and get a bolt out of stock to fit. The important point is to see that the taper reamers are kept sharp and to the proper taper and that the cutters on the machine are ground properly.

Pneumatic tools are real labor savers. The foremen should instruct his men in the proper use and care of these tools; the main thing is to see that the air drills are properly lubricated. More air drills are ruined from the lack of oil than from any other cause. The air hammer should be more generally used in the erecting shop. Remember, the operator will more than double the output with it over the old way of using hammer and chisel. Instruct your apprentices early how to use the air hammer.

One of the handiest appliances for the roundhouse and erecting shop is a tool box mounted on a truck; have the box made large enough to hold all necessary tools to suit the operator's special work. This saves time and material. To illustrate, the man that works on guides will find it handy to keep liners, temporary bolts, washers, extra guide blocks, files, chisels, copper hammer—in fact, all necessary appliances to do his work—in this box. By following this plan you will get out more work at a reduced cost. The same applies to the men that work on valves, brakes and all special lines of work. I believe in specializing your men wherever you can, as this will increase the output and at the same time take care of your small tools, as each man is responsible for the tools under his care.

SELECTION AND MAINTENANCE OF MACHINE AND HAND TOOLS.

BY AN "OLD RAILROADER."

SELECTION OF MACHINE TOOLS.

This is a matter that needs careful attention and study: *First,* to determine the work that is to be handled. *Second,* the amount of work that will have to be handled each day in order to keep up the supply so that all orders may be filled promptly and with the least possible delay. *Third,* the make of machine, taking into consideration its strength and ease of manipulation, and accessibility for making repairs. *Fourth,* the nature of power used to drive the tool, as upon this depends a greater or less percentage of fixed charges that have to be taken care of. There should be no question as to which is the best power for any machine shop, no matter what size or number of machines it contains. Electric drive should be used; its first cost may be greater than the others, but it will return it in the saving at the coal bin and water meter, not taking into consideration the expense connected with countershafts, belts, line shafts and their accessories. *Fifth,* the cost of the machines, while most important from the standpoint of first cost, does not amount to much compared to the repair charges if a cheap lot of machines are selected. A machine or a number of machines represent so much money at interest; it is the rule in selecting stocks or bonds for investment to get the best and safest from the most reliable brokers. The same method should be pursued in buying tools of any description. Get only the best machine for the line of work you are going to handle, and from reputable firms who have the backing to make good any claim they put forward for their tools.

In the final selection of machine tools care should be taken that no unnecessary tool is put on the list. As stated at the beginning of this article, the kind of work to be handled should be carefully considered as to its weight, length, diameter and other dimensions. Upon these depend the sizes of lathes, planers, drill presses, boring machines, shapers, etc. Some makes of shapers will do the same work far cheaper than planers, and in one-third the time if handled properly. No useless machine should be installed. What is meant by this is plain to anyone who has had occasion to go through a railway machine shop, with few exceptions.

A 32 in. x 32 in. x 12 ft. planer is being used to machine a crosshead 28 in. long, clamped with a piston rod to a pair of V blocks; on the other side of the shop a 36 in. or 42 in. triple-geared engine lathe, with a 16 or 20 foot bed, and capable of taking 9 ft. to 12 ft. between centers, is being used to machine a crosshead pin measuring not over 12 in. in length and 5 in. in diameter, or, it may be working on a packing casting for piston valve rings 12 in. in diameter. Another lathe. 20 in. in diameter and 8 ft. between centers, is being used to turn up frame bolts 1¼ in. in diameter and 12 in. or 16 in. in length. This is also true of drill presses. A 36 in. vertical drill or a larger radial drill will be seen in use with a 3/16 in. or ¼ in. drill, drilling

knuckle-joint pins or similar work. A 30 in. shaper, 12 in. lathe and a 12 in. sensitive drill could have handled all of the above work, leaving the larger machines for more suitable work. There are many foremen and shop superintendents who never seem to realize that a planer or lathe used for short work for any length of time will rarely do a good job when used to its limit as to length. This should not be lost sight of when installing machinery in any shop, either railway or otherwise.

Many railways are concentrating their heaviest machinery at two or more central points and either sending material out finished or sending engines into these shops for the heavier class of repairs. This leaves only the lighter work to be handled at division terminals, and as a result lighter machines may be used at these points.

CARE OF MACHINE TOOLS.

Foremen in charge of machine shops are directly responsible for machines, as the care or abuse that they receive depends upon the methods pursued in handling the men and the work. It is the foreman's duty to see that all machines are properly cleaned and oiled and that no abuse of any kind is given any part of the machines, either by throwing work on the tables or ways or the use of any part of a machine for an anvil block in driving out bushings, centering bolts, etc. When the men and apprentices see that they must take care of machines as if they were their own, there will be smaller repair bills and fewer idle machines. Each man will take a pride in his machine and make every effort to beat his neighbor. This will in the end work to the foreman's advantage as well as to the owner's. At least ten minutes should be allowed each week to every man or boy to clean any cuttings, etc., from under the crossfeeds and carriages of lathes and around the gears of all machines. The life of the machine depends on this and it will yield a far better return than the same amount of work applied directly to output.

The writer has in mind a small lathe that was on exhibition at Philadelphia in 1876. It was placed in a tool and brass room the same year and at this writing, after being used continuously, is in far better condition than machines that have been in use only two years, proving that it pays to take care of a machine by keeping it clean and properly oiled. The foreman is directly responsible for the selection of work for each machine tool, and if the machine is abused by doing work that should be done on a more suitable tool the men should not be blamed, as they are only doing as directed.

THE ABUSE OF HAND TOOLS.

This is also chargeable to the foremen, if they fail to impress on the men the importance of taking care of hand tools. The expense for this class of equipment goes up, with the result that the money thus spent is nine times out of ten diverted from the amount allowed for labor, which results in short time or a reduction in force; in nearly all cases the parties at fault are not the ones to suffer.

As a rule, there is enough supervision in all shops and repair yards, if properly handled, to see that abuses of any kind are stopped. Following are a few cases to show how expenses for tools are increased by neglect on the part of foremen and leading mechanics: Holes to be tapped are not drilled to the proper size and taps are broken in trying to start, some using a hammer to drive them, others grinding the tap with the mistaken idea that it will help. Drilling the holes too large results in a poor fit and perhaps leads to an accident in a short time. Reamers are run at excessive speed, especially on car work, due in the majority of cases to having men that do not know how to handle air motors. There is not enough care taken when laying out holes in patches or reinforcing plates, etc. Nor is there enough attention paid to the drilling or punching of holes. This is the main cause for the use of reamers in steel car repairs. There were over 200 reamers, from 9/16 in. to 1 1/16 in., sent in to the tool room from one repair yard for regrinding and tempering in nine days a year or so ago, and they were continually calling for more tools.

The manner in which air motors and hammers are handled is as bad, if not worse. Instead of being placed on a rack or some other receptacle when not in use they are thrown on the ground and the motors are rarely shut off. As yards are made up of all kinds of filling it is easy to estimate how long a motor will last. Anything that is in the way or repair parts that are needed for cars are likely to be thrown on the motor or the hose. The damaging of hose by the careless handling of material often causes unnecessary expense and delay. To illustrate: A certain gang had considerable trouble with a particular motor for a couple of days and also with air hammers. They could not be made to work right and after the second trip to the shop it was decided to send a man to the yard to locate the trouble, as the tools worked properly at shop when tested. He found that the trouble was due to the hose and not to motor; the inner lining was loose and the action of air in flowing to the motor closed it, with the result that no air could reach the motor.

The above cases serve to show that the fault can often be traced to the foremen and leading men, inasmuch as they fail to instruct the men and follow it up to see that the instructions are carried out. In case the men placed in charge do not know enough to instruct those in their charge blame must be placed on those higher up.

Anyone that has had any experience in the handling of men, either in locomotive or car repair shops or yards, can tell at a glance in going through them whether they are managed by a practical mechanic or not, and this without looking at the condition of the machines or tools, but by the way repair parts and material are distributed and handled.

The managements, if they look over the expenses for tools and repair parts at the end of any period, can easily tell the kind of men they have—a large expense account shows plainly that no care is given to this matter and a low expense account indicates care and ability on the part of the foreman, all other conditions being equal.

FOREIGN RAILWAY NOTES.

Less than three years of extensions of Brazilian lines, building of new lines into the south of Brazil, and a discreet policy in the matter of buying stocks in the old companies has not only brought about a unification of the railways, but has brought a practical monopoly of the railway systems of all south Brazil which connect the city of Sao Paulo, and thereby Rio de Janeiro and points in the states of Minas Geraes and Espirito Santo with the southernmost cities of Brazil and with River Platte and Paraguayan points. The management of the interest thus involved has not materially changed, except that the capitalists in control are mostly American rather than Canadian, and that the strong influx of French capital brought about by the sale of much stock in France has given the syndicate a distinctively French-American rather than Canadian-American complexion as before. Effectively, the leaders in the movement are the incorporators of the Brazil Railway Company of Portland, Maine, in whose name are held not only the concessions for Sao Paulo-Rio Grande railways, but the lease of the Sorocabana Railway, which forms the connection for the former with Sao Paulo. Of late it has acquired controlling interests in the Paulista and Mogyana railways in the State of Sao Paulo. The success of this movement toward unification is the beginning of a new era in railway building and operation in Brazil. Heretofore the operation of a Brazilian railway by private capital has been contingent upon a guaranteed profit from federal or state governments. The one exception has been that of the British-operated Leopoldina railway system.

A line to connect Tupiza with Uyuni on the Antofagasta Railway is also under construction, at an approximate cost of $9,075,000. Tupiza is the center of another area of vast mineral wealth.

EDUCATING APPRENTICES ON THE SANTA FE.*

BY F. W. THOMAS.

Supervisor of Apprentices, Atchison, Topeka & Santa Fe, Topeka, Kan.

School Work.—In each shop a building or room has been set aside, known as the apprentice school room, in which the boy is required to spend two hours a day, two days a week. Here he is taught free-hand and mechanical drawing, practical shop arithmetic, the simpler elements of mechanics, and certain geography and history relating entirely to the road. The school rooms are furnished with drawing tables, blackboards, cabinets, models, maps, and other paraphernalia common to an academy or college lecture room. A technical and practically educated man presides over these school rooms and is known as the apprentice school instructor. His services, as well as the school room, a set of first-class drawing instruments, a drawing table, stationery, etc., are furnished the apprentice absolutely free. Furthermore, the apprentice is paid his regular rate while attending school. The instruction given the boys while in the apprentice school room is individual; a boy just completing his apprenticeship and a youngster just starting out may be working side by side. There is really no class instruction, and the boys are not treated as a class, but each one is instructed individually.

There is no bunching of boys together, rushing the duller and slower boys over the course, or holding back the quick, energetic boys, but each one progresses just as fast as his ability or capacity will permit. Each individual must be thoroughly familiar with the work at hand before he is allowed to proceed to some higher branch or more difficult work. No text books are used, but standard lesson sheets, written and printed in the office of the supervisor of apprentices, are sent to each of the schools. These lessons are simple, but they are prepared with the idea of teaching and drilling the boy along a certain line, giving him what he actually needs in the trade he is learning, leaving out all foreign subjects and frills. Each lesson refers to some part of a locomotive, car, shop tool, or feature common to railway work. As an illustration, all problems in fractions are of a denomination found on a machinist's scale, that is, 64ths, 32nds, 8ths, 4ths, etc. Mechanics in railway shops have no use for 7ths, 9ths, or 13ths of an inch. The drawing lessons, both mechanical and free-hand, like the problem sheets, are taken from some part of an engine, car or shop tool. The boys are taught how to draw these parts, and to readily read and interpret a mechanical drawing or blueprint. We care nothing about his ability to draw a tree, a horse, or a wagon. Everything taught him in school has some direct bearing on the trade he is learning. Teaching a boy subjects foreign to his trade, giving him lessons in drawing of objects other than those with which he is familiar and with which he daily comes in contact, tends to make his mind wander and often makes him dissatisfied with his vocation.

Apprentice school instructors are selected with great care. As a rule, young men are preferred to older ones, as there is a greater tendency for younger instructors to "mix" with the boys and to become a part of them, join with them in the organization of their teams of sport, and really become a part of their lives; an apprentice boy feels much freer in talking with younger apprentice instructors, than he does with older ones. These apprentice school instructors are young men thoroughly educated in college, university, and shop, and are thoroughly familiar with the standard practices and usages of the mechanical department. The function of the school room and of the apprentice school instructor is to teach the boy to use his brains along with his hands and eyes, to reason out, and to understand the work in the shop as he progresses.

Shop Instruction.—The apprentices are required to work in the shop like any journeymen, but they have the advantage of having a first-class, skilled mechanic to instruct and guide them. In the smaller shops a man is designated as shop instructor; and in the larger shops there is one man for each department, or one for each 25 or 30 apprentices, whose entire time is devoted to them. Any other duties given him must be subservient to his duties as shop instructor. He first explains the various parts of a machine, and the functions of each part; he teaches the boy how to chuck a certain piece of work in the machine, how to set his cutting tools, the speed to use, etc. He keeps within sight or hailing distance of all the boys under his care, and is ready at all times to render them assistance. The shop instructors are recruited from journeymen who have been in the service for sometime, men who are familiar with all of the machines in the shop, and thoroughly familiar with the standards, rules, methods and practices of the company. He must be a man of patience, a man with a boy-loving heart, one whose personal character is not only clean and elevating, but whose actions and conversation are such that the boy will look up to him with pride and honor. When the boys are in trouble he advises them, when they are sick he visits them—in fact, he encourages them in everything that goes to make them clean, honorable citizens, and above all, to be first-class mechanics. The boy entering our shops at the age of 16 is at a critical point in life and is in need at this time, above all others, of some strong but patient directing hand to guide and direct him. The apprentice system on the Santa Fe is not a merciless machine moving in a certain fixed path, but is flexible and humane from the very beginning. The abuse of any boy, however exasperating the case may be, is absolutely prohibited. Profanity towards a boy by either shop instructor or foreman is unknown, and although their teachings and instructions may be mechanical, they are of such a parental nature as to remove them from the mere mechanical.

The requirements for becoming an apprentice are not rigid, nor do we inquire particularly into the boy's life or character, neither do we require character letters. If the boy has been through the fifth grade of the public schools and is strong physically, and apparently bright, we give him a trial and in the first six months our shop and school instructors are able to determine his fitness for the trade he is indentured to learn. A few boys come to us who are really deficient in education, boys who have had to leave school in their tender years to assist in supporting a widowed mother, or younger brothers and sisters, and for these we have a night school where they are taught the branches in which they are deficient; as soon as they have progressed to a certain point they are released from night school and continue their work in the regular apprentice school. While such boys are often a little more expensive to train, we have really gained some of our best young mechanics from that source. The night schools are not considered a punishment and do not in any measure reflect on the boy's ability. It is a splendid opportunity for him to advance more rapidly, to learn a little more, so that he can keep pace with his more fortunate brother. The instructors exercise a modified military and parental discipline over the boys; the military discipline will insure immediate obedience and subordination; the parental discipline will assure the boys of the personal interest taken in them, and serve to teach them the importance of living a clean life, and the value and importance of becoming honest citizens.

At the smaller shops where we have four to six boys, we have a traveling instructor who spends his time at two or more places. He is both shop and school instructor. We turn out from these smaller points some of our best mechanics, especially for roundhouse work. The last year of their time is served in one of the larger shops where they may have the advantage of a greater variety of machines. Every apprentice is required to have a standard set of shop tools, these being sold to the apprentices at cost price by the company. This scheme provides a first-class set of tools at reasonable cost and with easy terms of payment. The company also furnishes each apprentice a tool box free of cost.

The instructor keeps a complete personal record of each boy—the progress he makes in shop and school, his shop efficiency,

* Abstract of a paper read at the annual convention of the National Society for the Promotion of Industrial Education.

class and quality of work performed, and his personal habits. These records are sent monthly to the office of the supervisor of apprentices, and are copied on his personal record. By requiring this, the instructor must keep close tab on all of his boys, and the headquarters can in a moment give a complete record of each boy on the system.

The greatest difficulty we have in inducing the better class of boys to go into the shops as apprentices is the practical social ostracism they must undergo. As a general rule, men working in railway shops are known as mechanics, some of whom have little pride as to their personal appearance, leaving their day's work with hands and face grimy and greasy, and often wearing the same overalls or clothing on the way home in which they work in the shop. We have been endeavoring to impress on our young men the importance of cleaning up before leaving the work at the shop, bathing frequently, and changing their clothes as often as their financial circumstances will permit; and to cease loafing on the street or at disreputable places. If they go to shows or places of amusement, to select the best kind, even if it is necessary to go less frequently; to be polite and courteous to everybody at all times. The effect of such instruction has been noted at a number of places—in fact, the personal appearance and social conditions at some of these places have been revolutionized. Such teaching has also made them more orderly in their work, keeping their shop tools, hand tools, and jigs clean and in the right place, no time being lost in hunting for calipers, scales, etc.

The apprentice boys are encouraged in athletics and here, as well as in the shop and school room, they are taught the value and honor of clean sport. While it may take years to fully accomplish what I might call the social elevating feature of this work, yet wherever we have an apprentice school, it has even now a decidedly elevating moral effect on the shop body. Furthermore, the apprentice schools are now regarded by the local shop officials as a necessary adjunct to the shop. The apprentice school is no longer considered an experiment; it is considered a necessity, and each master mechanic has a particular pride in his school, and no visitor to the shop is allowed to leave until he has visited the apprentice school room and is made thoroughly acquainted with the method of handling apprentices. The higher officials, the president, vice-president, and superintendent motive power, always favor these schools with a visit whenever they are in the vicinity.

Considerable objection for a time was raised to the establishment of the apprentice schools on account of the cost. While we know exactly what it costs us to educate each apprentice, we also know what the apprentice is doing, and although the Santa Fe is spending from $35,000 to $40,000 a year training boys for its future needs, yet with the help of the school and shop instructor, these boys are accomplishing enough more work to more than pay for the cost of instructing them. Our primary object is to make mechanics for our shops. We can hire all the mechanical engineers we want, hire all the draftsmen we need, employ all the college men we want, but our pressing need, not only ours but that of the railways and manufacturing plants all over the country, is first-class skilled mechanics. The mechanics we graduate are certainly better suited and fitted to our needs than those we can hire, for they know the Santa Fe ways, Santa Fe methods, and Santa Fe standards. It is a common occurrence for gang foremen to put in bids in advance for some apprentice that they know will shortly be out of his time.

Under the old system of indenturing a boy to learn a trade, where the master acted towards the boy as a father to a son, good, all-around mechanics were the result, but under our modern method, there are not enough fatherly employers. The foreman of the shop is too busy to stop, to help or to show a boy. The boy is simply turned loose in the shop to rise or fall, and to pass away the four years, eventually leaving at the expiration of his apprenticeship, knowing really very little of the trade he was apprenticed to learn. The labor unions of the country have limited the number of apprentices in some shops to such an extent, that even if they were properly trained, there are not half enough to meet the demand.

Nothing will ever take the place of apprenticeship. There is no trade school or training school in the country that will turn out young men or boys who are capable of entering a shop and competing with the average mechanic; while they may be taught considerable "book learning," their practical instruction must of necessity be limited. There is nothing that will take the place of practical experience. Manual training in our public schools and trade schools may bring out the talent, may display the genius, but the boy, even after completing such a course has no conception of time, no idea of the practical use of jigs, templets, etc. If a boy's mind is imbued with the idea that as soon as he graduates from a training school, he can enter a modern shop, and can work alongside regular journeymen, competing with them, he has been deceived. If a boy desires and intends to follow a trade for a livelihood, he should attend our public schools until he has reached the age of sixteen and then should enter a shop as an apprentice. Further schooling, I believe is unnecessary and in a measure is time wasted. By starting out upon his apprenticeship at the age of sixteen or seventeen, he will have completed it by the time he has reached his majority, and will be fully prepared to enter upon his life's work.

While the remuneration paid apprentices learning a trade has increased during the past few years, it is still too small. Many boys who would make first-class mechanics accept positions which have practically no future to offer, but whose immediate returns are greater than that of an apprentice during his four-year course. Apprentices must be paid living wages, sufficient for them to have nutritious food and to wear comfortable clothes. You cannot expect to develop the best in a boy when his body is lacking nutritious food and is not warmly clothed.

All apprentice instruction is during the daylight hours. Any corporation or manufacturing plant that requires the apprentices to return regularly at night to attend school is courting failure. The boys we have, the boys we desire, in fact the boys from whom we can make our best men, have an abundance of red blood coursing in their veins and must have some hours for recreation and play. After they have worked all day in the shop they are entitled to some time for recreation. While we are historically familiar with a number of men who during their childhood endured all kinds of privations and hardships to obtain an education, men who when boys after a day's work studied at night by dimly lighted lamps, thirsting for knowledge, these are rare exceptions and the historian deemed it of sufficient importance to record the fact. There are thousands of others who have studied at night and who are still living in the night. The present age offers so much to detract the boy; there are so many more places of amusement, so many more free entertainments, and the writer believes the boys should be allowed to enjoy themselves all they possibly can while in their teens. An apprentice boy who has worked in a modern shop all day is physically unfit to study in the evening. We have endeavored to make our apprenticeship system as attractive as possible. We want our boys to be as happy and contented in serving their apprenticeship as it is possible to make them; we aim to make them so contented and happy while learning their trade, that they will gladly continue in our service after completing their apprenticeship.

The Sorocabana Railway in Brazil has been modernizing its service by putting on up-to-date American day coaches, sleeping cars, American locomotives, and other equipment from the United States. Undoubtedly, as the French-American syndicate takes over the actual control of other Sao Paulo railways their equipment will be similarly modernized. Both the Paulista and the Mogyana have a diversity of gages, and the unification and standardization of these lines will mean a considerable sale for American steel rails.

General News Section.

The Pennsylvania Railroad has just finished the planting of 2,000 young trees at Vineyard, near Harrisburg, to be cultivated for the making of ties.

At Buc, France, December 30, Maurice Tabuteau broke the world's aviation distance record by flying continuously for seven hours and forty-five minutes making in that time a distance of 362.66 miles.

The Buffalo & Susquehanna has notified all employees that the demerits entered against them on the discipline records have been wiped off, so that the new year can be begun by each man with a clean record.

The Lake Shore & Michigan Southern is now running trains on the right hand track throughout all of its double track lines. The last division to be changed from left-hand running was that at the eastern end of the road. This was done December 27.

In the 24 hours ending at midnight, December 12, the Southern Pacific Company moved 915 cars over the Tehachipi mountain in central California. This record includes 80 passenger cars, hauled by 19 engines; and 835 freight cars, hauled by 46 engines.

The westbound Overland Limited express train of the Southern Pacific was stopped by two robbers on the morning of January 3, nine miles west of Ogden, Utah, and the valuables of about 100 passengers were taken; a negro porter who disregarded a command of one of the robbers was shot dead, and another porter was fatally injured. One passenger was slightly wounded. The robbers held the train for about an hour, but did not attempt to enter the express car.

Senator La Follette, of Wisconsin, succeeded in his request that the senate print the testimony which has been taken by the Interstate Commerce Commission in its numerous and protracted hearings on the question of authorizing a general increase in freight rates. The copy, which has been sent to the printer, fills 10,000 typewritten sheets. Some of the railways and a few shippers have bought copies of this testimony in mimeograph form, a single set of which cost, it is said, $1,400. Seventy sets have been sold.

The "Clearance Bill" introduced in Congress at the last session by Representative Martin of Colorado is to be the subject of a hearing by the House committee. It will be opposed by the legislative committee of the American Railway Association. The bill provides that the maximum width of locomotives in service after Jan. 1, 1912, shall be 10 feet 6 inches over all, maximum height of all cars to top of running board 14 feet 2 inches, that no structure of any kind, including tunnels, rock cuts, etc., shall be closer to any track than 6 feet 11 inches, that overhead clearances be 20 feet in all cases and that tracks must be 12 feet 6 inches apart, center to center, in all cases.

The Pennsylvania Railroad has ordered from the Western Electric Company a complete installation of telephones, with selector calling apparatus, for the use of the train despatcher and train directors between Philadelphia and West Philadelphia. Between these points there are six main tracks and part of the way eight. Ordinarily all orders for unusual movements are given from Tower A at Seventeenth street, close to the Broad street terminus, but there is a despatcher's office at Tower S at Thirty-second street, from which orders can be given in emergencies; and the calling apparatus is arranged so that orders can be sent to any one of the fifteen telephone stations in this territory as readily from Tower S as from Tower A. At Tower A, the calling apparatus is provided in triplicate so as to enable any one of the three operators to call any station without delay.

The special commission appointed in Massachusetts by the legislature to examine the property of the New York, New Haven & Hartford, with a view to seeing whether it was overcapitalized, has made its report and reaches a conclusion favorable to the company; that is to say, that the assets are sufficient to secure the outstanding stock and debts. The statement presented was as of June 15, 1910. The aggregate valuation of the property is not published, but it is said to have been found to be very much greater than the total amount of stock and bonds.

Some of the trains in the subway of the Interborough Rapid Transit Company, New York City, are now equipped with automatic electric apparatus for giving the all-right or starting signal. This signal is given in the cab of the motorman by an electric bell, and the bell is energized by a circuit which is closed only after every door in the train has been shut. It is estimated that with this arrangement the starting signal can be given about four seconds earlier than is practicable by the use of the hand bell rope.

The Interborough Rapid Transit Co., New York, has notified the Public Service Commission that it is an unconstitutional body, and that its orders of December 23 and December 28 will not be complied with. These orders pertain to the running of trains in the subway sufficient to provide seats for as many passengers as offer themselves each fifteen minutes throughout the day and night. This order was made on December 28, and is a modification of an order made in April last ordering the company to run sufficient trains to provide seats for all passengers in each period of thirty minutes. In his letter President Shonts says that the terms of the order of December 28 are impossible of performance; that the order makes no provision for the temporary prevention of the company from complying with it by accident or other controlling emergency for which the company is not responsible, and that in this respect it is unjust and unreasonable; that the order deprives the company of the right of management and protection of its property; that the order illegally substitutes the judgment of the Public Service Commissioners for the judgment of the Interborough company's directors and stockholders; that the order impairs the obligation of contracts to which the company is party in violation of the constitution of the United States; and furthermore that the law under which the commission purports to act, known as the Public Service Commission law, is unconstitutional as not having been duly enacted in accordance with the laws of the state of New York. The commission has fixed January 12 for the rehearing. The order requires the company either to reduce from 30 to 15 minutes the "period of observation," or given time within which sufficient seats are supposed to be supplied for all passengers, or to operate the maximum service at all hours. The complaint has been that the company has been bunching its trains at the end of the half-hour period, a dearth of trains being produced thereby during all but the last five minutes of each period.

William E. Corey.

Judge Elbert H. Gary, chairman of the board of directors of the United States Steel Corporation, announced on January 3 that William E. Corey had resigned his position as president. Judge Gary said in part: "The resignation will take effect at the pleasure of the board of directors and it is the present opinion of the members of the finance committee that there should not be elected a successor as president in the immediate future, if at all. The finance committee may recommend the election of two vice-presidents who will be expected to take charge of the commercial and manufacturing departments. It is intended to strengthen the whole organization in every respect practicable and useful." Judge Gary said further that the relations between Mr. Corey and the members of the board and the finance committee and all the officers of the corporation have been most pleasant and agreeable. It will be remembered that Mr. Corey succeeded Charles M. Schwab to the presidency in 1903. Since March, 1907, Mr. Corey's position has been subordinate to Judge Gary's as chairman of the finance committee and of the board of directors. Since that time all public utterances on the corporation's affairs have come from Judge Gary.

It is said that Mr. Corey will continue to be a director in the corporation.

Brains Wanted.

There is a railway problem, of course, and no one dissents from the proposition that the roads should be compelled to deal justly with the public and that rates should be as low as consist-

ent with the rights of the owners and the interests of the public. But entirely too many shallow minds are fooling with this problem. Perhaps most of them are inspired by good intent * * *. —*Houston (Texas) Post.*

Conductors' and Trainmen's Pay Increased.

A committee of managers representing the western lines and representatives of the conductors' and trainmen's unions reached an agreement at Chicago on December 29, under which the wages of the conductors and trainmen on these lines, estimated to number 75,000, are to be given an advance in wages of 10 per cent. The aggregate amount of the increase will be about $5,000,000 a year. The companies were represented in the negotiations by A. W. Trenholm (C., St. P., M. & O.), chairman; C. W. Kouns (A. T. S. F.); T. J. Foley (I. C.); J. W. Maxwell (St. L. S. W.); A. Price (C. P.); F. H. Ustick (C. B. & Q.); George H. Emerson (G. N.); W. R. Scott (S. P.); C. H. Hubbell (C. R. I. & P.), and H. B. Earling (C. M. & St. P.). The Order of Railway Conductors was represented by A. B. Garretson, president, and the Brotherhood of Railroad Trainmen by W. G. Lee, president. The following are the railways that are parties to the agreement and the articles of agreement:

Atchison, T. & S. F.—Eastern Lines.
Atchison, T. & S. F.—Western Lines.
Atchison, T. & S. F.—Coast Lines.
Gulf, Colorado & Santa Fe.
Santa Fe, Prescott & Phoenix.
Canadian Northern (B. of R. T. only).
Chicago & Alton.
Chicago & Northwestern.
Chicago, Burlington & Quincy.
Chicago, Milwaukee & Puget Sound.
Chicago, Milwaukee & St. Paul.
Chicago, St. Paul, Minneapolis & Omaha.
Colorado & Southern.
Duluth, South Shore & Atlantic.
El Paso & Southwestern.
Ft. Worth & Denver City (including Wichita Valley).
Frisco System (including lines in Texas).
Great Northern.
Illinois Central.
Indianapolis Southern.
International & Great Northern.
Kansas City Southern.
Minneapolis, St. Paul & Sault Sainte Marie.
Missouri, Kansas & Texas.
Missouri Pacific System.
New Orleans, Texas & Mexico (O. R. C. only).
Beaumont, Sour Lake & Western (O. R. C. only).
Orange & Northwestern (O. R. C. only).
Northern Pacific.
Oregon Railroad & Navigation Co.
Oregon Short Line.
Quincy, Omaha & Kansas City.
Rock Island Lines (except Yardmen).
St. Louis, Brownsville & Mexico (O. R. C. only).
St. Louis Southwestern System.
St. Joseph & Grand Island.
San Antonio & Aransas Pass.
San Pedro, Los Angeles & Salt Lake.
Sunset-Central Lines
Houston & Shreveport (O. R. C. and Yardmen).
Houston, East & West Texas (O. R. C. and Yardmen).
Houston & Texas Central.
Galveston, Harrisburg & San Antonio.
Louisiana Western.
Texas & New Orleans.
Morgan's Louisiana & Texas.
Southern Pacific Co.—Pacific System.
Texas & Pacific.
Trinity & Brazos Valley.
Union Pacific.
Yazoo & Mississippi Valley.

Article A.—An increase of ten (10) per cent. on existing rates is granted conductors, brakemen, flagmen and baggagemen in passenger service.

Article B.—It is agreed that the railways will not make reductions in crews or increases in mileage for the purpose of offsetting the increase of wages given passenger trainmen.

Article C.—An increase of ten (10) per cent. on existing rates is granted conductors, brakemen and flagmen in all freight, work, wreck, mixed, pusher and helper service. This increase not to apply to pusher or helpers now paid yard rates.

Article D.—Upon roads having a better basis for a day's work, or for payment of overtime or other rates or allowances in passenger, freight, mixed, work, wreck, pusher or helper service, the adoption of the foregoing rates and rules shall not operate as a reduction thereof.

Article E.—The increases granted by the Conference Committee of Managers to also apply to all rates for special or incidental service as specified in the individual schedules.

While the Canadian Pacific signed the agreement, its employees declined tentatively to accept it.

The Railway Strike in Italy.

The Italian railway strike has been postponed until the end of January, to give the government and parliament time to amend the bill granting the employees an increase of pay aggregating $4,000,000 annually. Objection to the measure is made on the grounds that the increase should be greater and proportioned differently. The government is taking precautions to insure railway service by recruiting emergency locomotive drivers.

Railway Signal Association.

Secretary C. C. Rosenberg, Bethlehem, Penna., has issued the December number of the *Journal* of the association, containing the doings of the annual meeting which was held at Richmond, Va., last October. It appears from this report that the changes in the constitution which were proposed at the meeting have all been adopted by letter ballot, except that which proposed a change in the dividing line between the East and the West. Instead of this, the association adopted the alternative amendment abolishing the dividing line, and the Board of Direction, which is the new name of the executive committee, will now consist of 15 members. It is expected that with this enlargement the question of geographical representation will take care of itself. The principal amendments, aside from this, are that correcting inequality in the votes of representative members who represent several different railways and that requiring the president to consult the Board of Direction in making appointments of members of committees.

Central Railway Club.

The annual meeting and dinner of the Central Railway Club will be held at the Statler Hotel, Buffalo, N. Y., on Thursday, January 12. The features of the business session in the afternoon will be the annual reports and a paper by W. O. Taylor on "Lubrication for High Pressure Slide and Piston Valve Locomotives," both non- and superheated type. The result of the vote for officers for the ensuing year will also be announced.

American Society of Civil Engineers.

At the meeting of the American Society of Civil Engineers, held in New York, January 4, a paper by Henry Earle Riggs, M. Am. Soc. C. E., entitled The Valuation of Public Service Corporation Property was presented for discussion. This paper was printed in the November number of *Proceedings.*

American Society of Mechanical Engineers.

At the next meeting of the American Society of Mechanical Engineers, on January 10 in New York, a paper will be read on "Mechanical Handling of Freight," by Samuel B. Fowler, of Boston, Mass. The subject will be discussed by railway officials and officers of large supply houses.

International Railway General Foremen's Association.

The International Railway General Foremen's Association will hold its next convention in Chicago, July 25-27, 1911, instead of in May.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.
American Association of Demurrage Officers.—A. G. Thomason, Scranton, Pa.; next meeting, June 22, 1911; Niagara Falls, N. Y.
American Association of General Passenger and Ticket Agents.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn., 1911.
American Association of Local Freight Agents' Association.—G. W. Dennison, Pennsylvania Co., Toledo, Ohio.
American Association of Railroad Superintendents.—O. G. Fetter, Carew building, Cincinnati, Ohio.
American Electric Railway Association.—H. C. Donecker, 29 W. 39th St., New York.
American Railway Association.—W. F. Allen, 24 Park Place, New York.
American Railway Bridge and Building Association.—C. A. Lichty, C. & N. W., Chicago; Sept. 17-19, 1911; St. Louis, Mo.
American Railway Engineering and Maintenance of Way Association.—E. H. Fritch, Monadnock building, Chicago; March 21-23, 1911, Chicago.
American Railway Industrial Association.—G. L. Stewart, St. L. S. W. Ry., St. Louis, Mo.; May 6, 1911; Detroit, Mich.
American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony building, Chicago; June 14-16, 1911, Atlantic City, N. J.
American Railway Tool Foremen's Association.—O. T. Harroun, Bloomington, Ill.
American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.
American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wednesdays, except July and August; annual, Jan. 18-19, New York.
American Society of Engineering Contractors.—D. J. Haner, 13 Park Row, New York.
American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 29th St., New York; Jan. 10; New York.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 26, 1911; New Orleans, La.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—J. R. McSherry, C. & E. I., Chicago; May, 1911; Montreal, Can.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—G. B. Colegrove, I. C. R.R., Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, 135 Adams St., Chicago; June 19, 1911; Boston, Mass.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Place, New York; June 20-21, 1911, Cape May City, N. J.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tuesday in month, except June, July and Aug.; Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays; Montreal, annual, last week January.

CAR FOREMAN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo, N. Y. Next annual meeting, Jan. 12, Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug.; St. Paul.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday; annual, Jan. 17, 1911; Chicago.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Duluth, Minn.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—H. D. Judson, 209 East Adams St., Chicago; Wednesday preceding 3d Thursday; Pittsburgh.

OMAHA RAILWAY CLUB.—A. H. Christiansen, Barker Blk.; second Wed.

INDIANAPOLIS RAILWAY AND MECHANICAL CLUB.—B. S. Downey, C., H. & D., Indianapolis, Ind.

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York; next convention, Omaha, Neb.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; May 15-18, 1911; Chattanooga, Tenn.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn. Next convention July 25-27, Chicago.

INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio.

INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.

IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 19-21, 1911, Atlantic City, N. J.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION, OF UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass.

NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept.; Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.

NORTH-WEST RAILROAD CLUB.—T. W. Flannagan, Soo Line, Minn.; 1st Tues. after 2d Mon., except June, July, August; alternately at St. Paul and Minneapolis, Minn.

NORTHERN RAILWAY CLUB.—C. L. Kennedy, C., M. & St. P.; 4th Saturday; Richmond, Va.; 20th annual, June 21, 1911; St. Paul, Minn.

RAILWAY CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City; 3d Friday in month; Kansas City.

RAILWAY CLUB OF PITTSBURGH.—C. W. Alleman, P. & L. E., Pittsburgh, Pa.; 4th Friday in montn, except June, July and August; Pittsburgh.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; annual, May 22-24, 1911; Milwaukee, Wis.

RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Oct., 1911; St. Louis.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.

SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Prudential bldg., Atlanta, Ga.; 3d Thurs.; Jan., April, August and Nov.; Atlanta.

TOLEDO TRANSPORTATION CLUB.—L. G. Macomber, Woolson Spice Co., Toledo; 1st Sat.; annual, May 6, 1911; Toledo.

TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; 1st Sat. after 1st Wed.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August; New York; Jan. 17.

TRAFFIC CLUB OF PITTSBURGH.—T. J. Walters, Oliver building, Pittsburgh, Pa.; meetings monthly; Pittsburgh.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 20, 1911; Baltimore, Md.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August; Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.

WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, First National Bank bldg., Chicago; annual, Jan. 17-19, 1911; Chicago.

Traffic News.

The Canadian Railway Commission has ordered the express companies of Canada to file with the commission within three months tariffs showing reductions in rates of at least 10 per cent.

A press dispatch from Ottawa says that the Canadian Pacific and the Canadian Northern, both of which roads run their own sleeping cars, are to reduce the prices of upper berths to correspond with the reduction which is to be made by the Pullman Company.

The Goodrich Transportation Company, which operates a boat line on the Great Lakes from Chicago, has brought suit in the federal court at Chicago to enjoin the Interstate Commerce Commission from compelling it to comply with the commission's regulations regarding the methods of accounting to be used by inland water lines. It states that but 20 per cent. of the business of the company is interstate, and that, therefore, the enforcement of the commission's rule as to it would be unreasonable.

N. E. Weeks, for the past 25 years chairman of the New England Passenger Association, and George H. Watson, secretary of the same for 12 years, terminated their services in these offices on December 31. In accepting the notices of their intention not to accept re-election, the association passed complimentary resolutions; and testified to the sincerity of the views expressed by giving the retiring officers a complimentary luncheon. The luncheon took place at the Boston Athletic Association, on Wednesday, December 21. There was a poem by Cy Warman.

The railways carrying freight to the Rocky mountain region have filed their tariffs, showing rates reduced in accordance with the decisions made by the Interstate Commerce Commission in the Spokane and cognate cases; and the merchants—or, at least, some of them—can truly say that they have succeeded "beyond the dreams of avarice"; for, according to a press despatch from Washington, the reductions "vary from 9 to 110 per cent." We expect from our Washington correspondent, in time for use in next week's issue, a photographic reproduction of one or more of the tariffs in which the carrier agrees to transport the shipper's goods for nothing and in addition to present the consignee with a bag of gold, of value equal to 10 per cent. of the price that would have been charged as freight under the former tariff.

Proposed Joint Traffic Commission with Canada.

Chairman Knapp, of the Interstate Commerce Commission, and J. P. Mabee, chief commissioner of the Canadian Railway Commission, have concluded the negotiations which they have had in hand for several months past and have recommended the creation of an international commission to regulate traffic between this country and Canada. The report has been sent to the secretary of state and the diplomatic representatives of the two countries will present to their respective legislatures a treaty to carry out the recommendations. The report says that for control of through rates, through routes, and other matters properly the subject of joint regulation, the establishment of such an international commission would be advantageous to both countries; that the regulation to which international carriers should be subjected is substantially similar to that provided for interstate carriers of the United States; that the International Commerce Commission should consist of four members, the chairman and one member (to be named by the President and Governor General) of the commission of either country; that the control of this commission should extend to telegraph, telephone and express companies; that international carriers by water should not be so controlled except when and to the extent they unite with rail carriers of either country in forming through mixed water and rail routes. Two provisions of the treaty as outlined by Messrs. Knapp and Mabee are that the international commission shall not hear claims for reparation and that it shall not prosecute criminal proceeding against shippers or carriers.

Car Surpluses and Shortages.

Arthur Hale, chairman of the committee on relations between railways of the American Railway Association, in presenting statistical bulletin No. 85-A, giving a summary of car shortages and surpluses by groups from August 18, 1909, to December 21, 1910, says:

"The total surplus for this report is 62,118, an increase of 8,203 cars. Of this increase, 6,868 are coal and gondola, and 1,473 flat cars. The large increase in coal is apparently due to the holiday season. While the total box car surplus is practically unchanged, the situation by groups shows a decreased surplus in the East, South and Northwest, with increased surplus in the West, Southwest and in Canada. There is little change in the shortage figures, the total showing a decrease of 1,191 cars, chiefly box and miscellaneous.

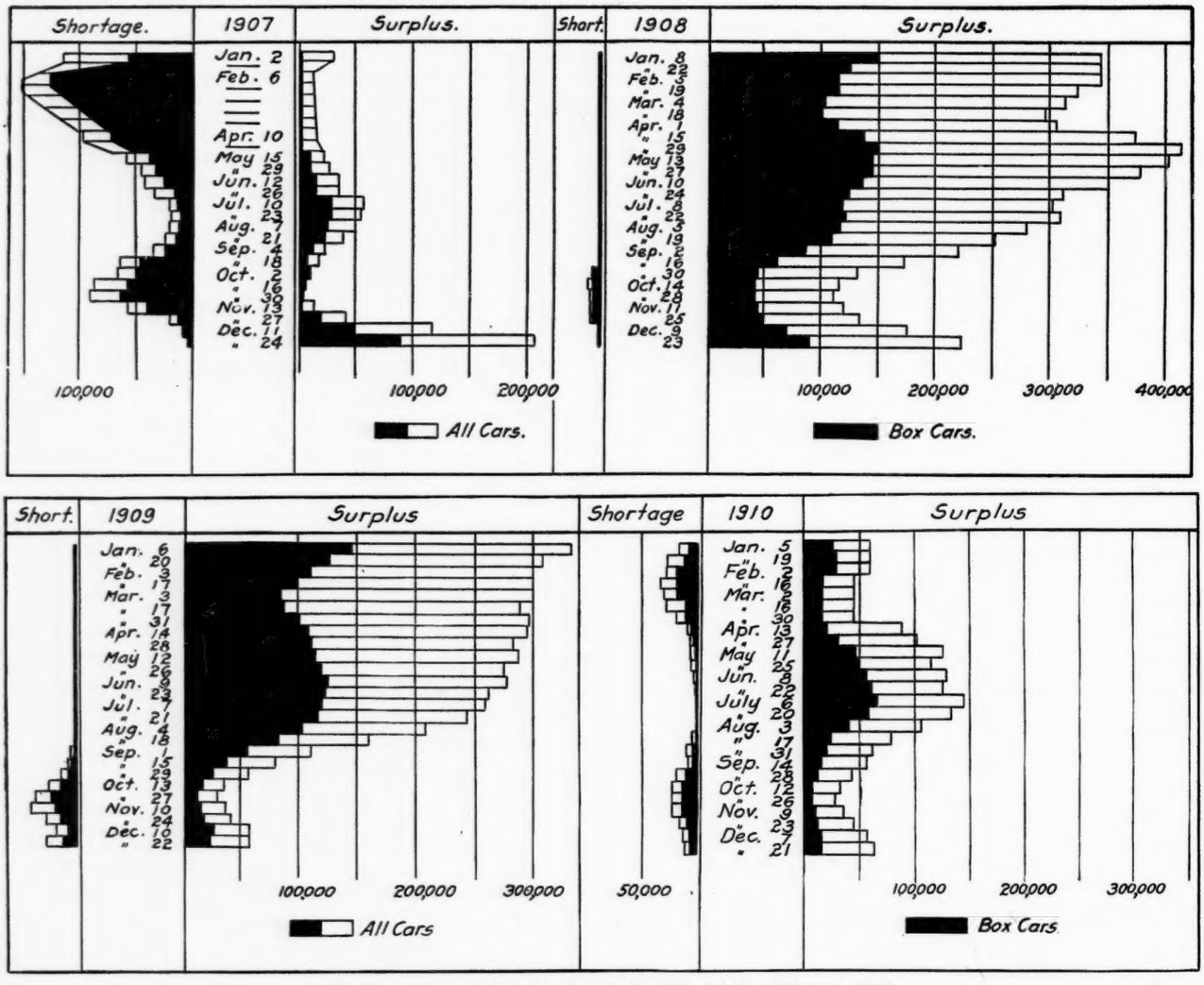
The total surplus is 3,764 cars greater than for the corresponding period in 1909, this being the first report during 1910 that shows an increase over the 1909 figures. Analysis by classes, however, develops that the box car surplus is 7,831 cars less than last year, while coal car surplus shows an increase of 10,436. The total shortage is 13,351 cars less than last year, the reduction being about evenly divided between box and coal cars."

The accompanying table gives surpluses and shortages by groups for the last period covered by the report and the charts show the total surpluses and shortages in the years 1907, 1908, 1909 and 1910.

CAR SURPLUSES AND SHORTAGES.

Date.	No. of roads.	Surpluses					Shortages				
		Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
Group *1.—December 21, 1910	8	279	868	897	304	2,348	151	31	150	166	498
" 2.— " 21, 1910	26	2,511	160	2,650	3,812	9,133	5	0	1,246	247	1,498
" 3.— " 21, 1910	25	1,285	383	6,690	2,334	10,692	428	0	305	864	1,597
" 4.— " 21, 1910	10	289	17	338	663	1,307	1,202	290	1,276	0	2,768
" 5.— " 21, 1910	19	53	20	404	420	897	1,341	600	50	18	2,009
" 6.— " 21, 1910	21	3,859	950	2,369	4,842	12,020	640	1	86	103	830
" 7.— " 21, 1910	4	317	376	823	598	2,114	0	0	0	0	0
" 8.— " 21, 1910	15	1,819	129	1,259	1,945	5,152	64	90	8	17	179
" 9.— " 21, 1910	11	1,363	100	403	775	2,641	250	0	0	0	250
" 10.— " 21, 1910	21	2,304	1,425	1,769	6,024	11,522	408	4	3	51	466
" 11.— " 21, 1910	5	2,374	930	47	941	4,292	509	0	0	101	610
Total	165	16,453	5,358	17,649	22,658	62,118	4,998	1,016	3,124	1,567	10,705

*Group 1 is composed of New England lines; Group 2—New York, New Jersey, Delaware, Maryland, and Eastern Pennsylvania lines; Group 3—Ohio, Indiana, Michigan and Western Pennsylvania lines; Group 4—West Virginia, Virginia, North and South Carolina lines; Group 5—Kentucky, Tennessee, Mississippi, Alabama, Georgia, and Florida lines; Group 6—Iowa, Illinois, Wisconsin, Minnesota and the Dakotas lines; Group 7—Montana, Wyoming and Nebraska lines; Group 8—Kansas, Colorado, Missouri, Arkansas and Oklahoma lines; Group 9—Texas, Louisiana and New Mexico lines; Group 10—Oregon, Idaho, California and Arizona lines; Group 11—Canadian lines.



Car Surpluses and Shortages in 1907, 1908, 1909 and 1910.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF OCTOBER, 1910. (SEE ALSO ISSUES DECEMBER 9, 16, 23 AND 30.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Atlanta & West Point	93	$55,066	$38,661	$103,189	$12,885	$16,999	$5,032	$28,899	$5,061	$68,876	$34,313	$273	$4,409	$30,177	—$7,519
Atlantic & St. Lawrence	167	68,899	26,158	105,134	34,829	19,689	3,805	54,132	2,609	115,064	—9,930	.....	8,452	—18,382	—66,752
Buffalo & Susquehanna *R.R.*	269	144,113	8,871	159,196	29,983	29,838	1,613	52,924	5,400	119,758	39,438	.....	2,600	36,838	—
Butte, Anaconda & Pacific	46	84,502	7,108	96,983	13,866	17,442	548	39,537	1,777	73,170	23,813	.....	2,000	21,813	—13,275
Chicago & Alton	1,025*	792,304	421,003	1,305,758	208,738	204,128	39,104	500,991	38,845	991,806	313,952	—277	32,700	280,975	—245,793
Chicago, Rock Island & El Paso	153†	44,879	20,635	72,439	9,103	10,593	1,083	23,629	2,751	47,159	25,280	—129	3,250	21,901	—23,522
Cincinnati & Muskingum Valley	148	54,496	25,080	84,885	11,052	11,872	1,949	34,503	1,512	60,888	23,997	.....	3,740	20,257	—14,051
Detroit & Mackinac	360‡	66,711	26,317	99,021	10,842	18,009	2,335	32,275	2,382	65,843	33,178	—135	8,250	24,793	—10,437
Detroit, Grand Haven & Milwaukee	190	125,912	47,659	194,863	36,282	19,392	6,326	80,922	4,381	147,303	47,560	—57	3,009	44,494	7,674
Eastern Ry. Co. of New Mexico	227	45,461	23,119	75,020	17,627	11,750	1,092	27,900	2,542	60,911	14,109	.....	4,735	9,374	—28,032
Fort Worth & Rio Grande	196	75,296	31,496	113,240	21,627	11,015	3,519	38,408	4,053	78,622	34,618	.....	2,141	32,477	17,259
Indianapolis Southern	179	76,145	22,066	103,306	27,419	14,864	2,670	35,287	1,859	82,099	21,207	.....	4,000	17,207	—4,189
Kansas City, Mexico & Orient	740§	133,598	46,440	189,964	30,917	31,672	7,978	77,420	9,426	157,412	32,552	.....	2,617	29,935	—3,174
Lehigh & Hudson River	96	127,577	3,738	133,302	14,365	19,819	1,084	40,429	2,770	78,467	54,835	.....	3,100	51,735	—402
Lehigh & New England	170	82,090	977	83,937	12,573	9,616	1,185	20,876	3,022	47,272	36,665	.....	1,500	35,165	6,743
Louisville, Henderson & St. Louis	200¶	66,021	36,910	108,943	28,725	11,828	4,204	33,668	2,728	81,153	27,790	483	2,666	25,607	5,952
Midland Valley	324	93,764	36,747	138,167	21,367	5,074	2,433	33,836	5,952	68,662	69,505	1,352	6,401	64,456	24,643
Missouri & North Arkansas	365	46,663	21,694	74,116	19,481	12,056	1,904	27,280	2,998	63,719	10,397	.....	4,250	6,147	—2,356
Nevada Northern	165	105,552	11,913	121,602	6,358	12,241	469	25,922	4,433	49,423	72,179	.....	3,122	69,057	—12,933
Pecos & Northern Texas	296‖	123,920	26,773	156,645	13,971	26,218	2,280	45,189	4,827	92,485	64,160	.....	3,834	60,326	—14,365
Quincy, Omaha & Kansas City	262	46,931	22,271	75,609	26,303	10,898	1,403	30,694	3,193	72,491	3,118	.....	3,000	118	5,398
Richmond, Fredericksburg & Potomac	83	83,874	71,642	178,318	24,333	22,381	2,686	59,319	5,681	114,400	63,918	.....	200	63,718	4,791
St. Louis, San Francisco & Texas	243*a*	70,822	33,117	109,278	18,083	15,295	2,997	57,011	3,875	97,261	12,017	.....	1,554	10,463	10,833
San Antonio & Aransas Pass	724	325,174	101,853	449,400	61,596	44,353	4,536	128,699	8,892	248,076	201,324	.....	9,000	192,324	39,020
Southern Ry. Co. in Mississippi	280	69,990	30,945	107,849	21,520	6,595	1,762	40,991	4,196	75,064	32,785	.....	4,596	28,189	2,782
Southern Kansas Ry. Co. of Texas	125	123,177	18,668	146,658	15,187	28,128	2,231	41,795	3,786	91,127	55,531	.....	1,553	53,978	—17,183
Spokane & Inland Empire	177	44,972	61,428	111,948	15,259	8,235	1,444	30,658	7,002	62,598	49,350	7,614	4,200	52,764	—15,120
Spokane International	141	83,508	24,236	112,555	18,663	5,735	2,310	30,544	3,488	60,740	51,815	.....	3,585	48,230	13,758
Texas Central	268	64,223	30,335	102,547	13,782	9,083	1,149	30,414	3,795	58,223	44,324	288	2,636	41,976	—2,320
Toledo, Peoria & Western	248	65,920	41,964	117,297	20,426	22,943	2,373	41,994	3,101	90,837	26,460	.....	5,000	21,460	—4,345
Toledo, St. Louis & Western	451	280,766	39,822	341,283	51,663	38,833	8,122	109,952	11,179	219,749	121,534	.....	13,900	107,634	—12,057
Ulster & Delaware	129	74,300	20,694	99,830	14,153	12,995	1,055	38,190	2,330	68,723	31,107	127	3,300	27,934	—4,893
Virginia & Southwestern	188	96,543	16,076	116,519	12,471	25,253	1,471	32,372	3,894	75,462	41,057	.....	4,523	36,534	698
Washington Southern	36	31,315	35,698	87,053	11,272	8,179	1,117	29,305	2,945	52,818	34,235	.....	2,345	31,890	5,344
Western Ry. of Alabama	133	67,830	44,951	123,704	16,044	19,920	4,864	30,689	5,261	76,778	46,926	—126	3,891	42,909	1,525
Wichita Valley	257	62,211	26,486	94,553	10,462	5,543	784	28,174	2,203	47,166	47,387	.....	2,500	44,887	14,033
FOUR MONTHS OF FISCAL YEAR, 1911.															
Atlanta & West Point	93	$189,686	$161,572	$384,634	$51,192	$69,154	$20,544	$109,843	$18,546	$269,279	$115,355	$740	$17,637	$98,458	$8,270
Atlantic & St. Lawrence	167	242,874	123,730	406,983	120,834	79,829	16,268	189,066	11,543	417,540	—10,557	.....	33,809	—44,366	—87,912
Buffalo & Susquehanna *R.R.*	269	436,763	31,711	489,766	107,043	82,987	6,223	157,392	18,848	372,493	117,273	.....	8,471	108,802	—
Butte, Anaconda & Pacific	46	337,057	44,752	405,289	49,057	64,182	2,751	159,421	7,375	282,786	122,503	.....	9,500	113,003	—8,045
Chicago & Alton	1,025*	3,227,496	1,666,813	5,252,212	739,476	771,177	152,066	1,847,857	136,848	3,647,424	1,604,788	—7,399	144,600	1,452,789	—549,341
Chicago, Rock Island & El Paso	153†	161,352	82,605	271,499	36,172	42,679	4,926	85,772	10,902	180,451	91,048	—940	13,700	76,408	—54,253
Cincinnati & Muskingum Valley	148	227,101	92,930	340,531	51,829	46,621	8,785	133,520	5,866	246,621	93,910	.....	14,440	79,470	—28,319
Detroit & Mackinac	360‡	266,100	127,053	418,413	43,660	63,718	8,975	130,521	10,305	257,179	161,234	3,124	33,413	130,945	6,292
Detroit, Grand Haven & Milwaukee	190	352,036	238,687	684,815	119,850	76,762	25,370	311,605	17,349	550,936	133,879	—20	12,036	121,823	—60,622
Eastern Ry. Co. of New Mexico	227	165,588	94,560	280,101	74,285	40,101	3,812	99,320	9,955	227,474	52,627	.....	16,539	36,088	—90,981
Fort Worth & Rio Grande	196	195,710	111,979	332,473	65,280	38,093	14,057	137,401	15,129	269,960	62,513	.....	10,271	52,242	15,248
Indianapolis Southern	179	298,292	94,529	409,073	87,777	59,627	11,637	142,660	6,812	308,513	100,560	.....	16,000	84,560	21,600
Kansas City, Mexico & Orient	740§	449,314	170,870	654,771	125,317	137,741	29,468	299,017	31,448	622,991	31,780	.....	22,483	9,297	—80,134
Lehigh & Hudson River	96	431,167	19,252	458,821	64,473	58,938	4,861	145,978	13,948	288,198	170,623	.....	12,400	158,223	3,426
Lehigh & New England	170	340,803	4,859	349,986	45,837	39,634	4,547	86,143	11,602	187,763	162,223	.....	6,000	156,223	31,542
Louisville, Henderson & St. Louis	200¶	247,074	152,030	426,610	107,685	45,483	17,818	127,362	10,029	308,377	118,233	1,602	10,667	109,169	9,850
Midland Valley	324	257,448	130,309	413,013	79,408	69,510	8,357	120,275	18,891	296,441	116,572	4,133	25,604	95,101	—3,814
Missouri & North Arkansas	365	181,155	112,127	315,097	84,669	48,400	8,115	111,178	12,184	264,546	50,551	.....	17,000	33,551	—3,551
Nevada Northern	165	415,716	49,247	481,535	30,790	51,471	1,328	97,943	15,837	197,369	284,166	.....	12,612	271,554	—32,365
Pecos & Northern Texas	296‖	416,962	109,427	551,992	71,308	81,462	8,107	160,687	18,646	340,210	211,782	.....	11,184	200,598	—35,419
Quincy, Omaha & Kansas City	262	152,259	90,113	265,533	91,938	39,557	5,573	108,535	11,028	256,631	8,902	.....	12,000	—3,097	47,309
Richmond, Fredericksburg & Potomac	83	381,034	258,872	728,389	120,413	89,552	11,845	247,713	22,218	491,741	236,648	.....	800	235,848	28,911
St. Louis, San Francisco & Texas	243*a*	232,139	94,721	344,648	68,908	47,335	11,613	183,051	14,642	325,549	19,099	.....	5,718	13,381	5,664
San Antonio & Aransas Pass	724	1,152,369	411,197	1,645,121	214,109	191,570	19,511	497,874	37,172	960,236	684,885	.....	36,000	648,885	163,437
Southern Ry. Co. in Mississippi	280	187,244	126,461	336,902	87,868	25,079	11,289	142,849	14,153	281,238	55,664	.....	18,378	37,286	11,420
Southern Kansas Ry. Co. of Texas	125	390,291	76,389	486,694	62,930	90,863	7,987	149,846	16,632	328,258	158,436	.....	9,014	149,422	—56,429
Spokane & Inland Empire	177	164,361	262,661	450,737	70,817	34,131	6,835	118,308	28,535	258,626	192,111	55,848	16,800	2,311,159	—161,855
Spokane International	141	294,912	92,664	410,412	70,240	22,165	9,789	107,906	13,027	223,127	187,285	.....	14,342	172,943	47,981
Texas Central	268	178,702	126,354	331,963	59,285	39,094	5,360	111,083	15,466	230,288	101,675	1,144	10,373	92,445	3,434
Toledo, Peoria & Western	248	259,668	173,449	458,343	77,334	83,371	9,406	160,372	12,650	343,133	115,210	.....	20,000	95,210	—3,373
Toledo, St. Louis & Western	451	1,055,824	183,318	1,320,377	186,288	158,081	33,647	433,233	39,413	850,662	469,715	.....	55,600	414,115	—41,056
Ulster & Delaware	129	285,580	206,711	515,017	66,570	50,304	6,795	185,863	9,465	318,997	196,020	144	13,200	182,964	—4,735
Virginia & Southwestern	188	355,872	55,707	426,586	49,509	89,862	5,983	118,113	12,761	276,228	150,358	.....	18,094	132,264	4,920
Washington Southern	36	132,984	135,413	352,360	39,517	28,262	5,043	123,102	9,605	205,529	146,831	.....	9,379	137,452	23,971
Western Ry. of Alabama	133	220,040	150,441	404,296	66,534	73,947	20,174	105,232	19,951	285,838	118,458	—853	15,563	102,042	11,791
Wichita Valley	257	171,478	102,745	292,750	49,119	21,115	2,476	97,614	8,624	178,948	113,802	.....	10,045	103,757	14,675

Mileage operated on October 31, 1909.—* 998 miles; † 111 miles; ‡ 347 miles; § 660 miles; ¶ 218 miles; ‖ 152 miles; *a* 132 miles; — indicates Deficits, Losses and Decreases.

INTERSTATE COMMERCE COMMISSION.

The commisison has suspended until May 1, 1911, tariffs on milk and cream, showing increased rates, presented by the Erie, the Lake Shore & Michigan Southern, the Pennsylvania Company, and a number of other roads in central territory.

Mr. Lyon, for the commission, and Mr. Brandeis, for the eastern shippers, have filed their briefs preparatory to the final argument, which is to be heard next week, before the commission, on the question of increased rates in the long distance freight tariffs of the trunk line railways. Mr. Lyon's "brief" fills 89 pages, and includes 50 statistical tables, while Mr. Brandeis' "brief" is a document of 178 pages.

The commisison on December 29, changed to April 15, the date to which a large number of freight tariffs are suspended. These tariffs, which deal mostly with "tap-line" rates, were suspended until January 5 with the expectation that before that date they could be heard and the commission could reach a decision as to whether or not they should be allowed to go into effect, but there has not been time to fully consider the cases.

Complaint Dismissed.

Empire Wall Paper Co. v. Boston & Maine et al. Opinion by Commissioner Clements:

Under the circumstances disclosed by the record in this case the commission is unable to find that the initial carrier was under the duty of routing the shipment other than as indicated in the shipper's instructions. (20 I. C. C. 1.)

Pabst Brewing Co. et al v. Chicago, Milwaukee & St. Paul et al. Opinion by Commissioner Lane:

Following *Liebold Co. v. D., L. & W.*, 17 I. C. C. 503, complainants' claims for reparation on various shipments of beer from Milwaukee, Wis., to points on the Pacific coast and in Colorado, Wyoming, western Nebraska, and New Mexico are denied. (19 I. C. C. 584.)

S. Running v. Chicago, St. Paul, Minneapolis & Omaha. Opinion by Chairman Knapp:

Complainant asks reparation in the amount represented by the difference between the published rate charged on his shipments of strawberries from Menomonie Junction, Wis., to St. Paul, Minn., and the rate which he understood to be in force; but in the absence of any proof that the rate exacted was or is unreasonable for the exclusive use of an iced refrigerator car between the points of shipment and destination, the complaint must be dismissed. (19 I. C. C. 565.)

R. Prahlow v. Indiana Harbor Belt et al. Opinion by Chairman Knapp:

Inasmuch as the record does not disclose a through rate in excess of the combination of locals, nor a case of misrouting, complainant's contention that the rates exacted were unreasonable is not sustained.

Although the commission adheres to the principle as to weighing announced in *Romona Oolitic Stone v. Vandalia R. R. Co.*, 13 I. C. C. 115, it is not of opinion that substantial justice requires its application to the switching service here involved. (19 I. C. C. 572.)

Differences in Pepper Rates Upheld.

Crombie & Co. et al. v. Southern Pacific et al. Opinion by the Commission:

A classification named same rating on "pepper" as on "chile pepper." Subsequently a commodity rate on "pepper" was established. The commodity rates should be strictly applied and such a rating on "pepper" does not take out of the classification any other article specifically named therein, however analogous, such as "chile pepper." (19 I. C. C. 561.)

Naming a Specific Rate for a Specific Consignee.

George N. Pierce Co. v. New York Central & Hudson River. Opinion by Commissioner Lane:

The charges collected by defendant for the transfer of five cars of less-than-carload freight, originating without the state of New York, from the Black Rock freight station in Buffalo, N. Y., to the private siding of complainant in Buffalo, found discriminatory because similar service was given by defendant without charge to other consignees whose traffic was handled under similar conditions. Reparation awarded.

The practice of naming specific consignors and consignees as entitled to certain service is objectionable not only on account of form but because it may often effect, as in the present instance, an actual discrimination between persons similarly situated and equally entitled to the carrier's service. (19 I. C. C. 579.)

Minimum on Empty Beer Kegs.

Fred Miller Brewing Co. v. Chicago, Milwaukee & St. Paul et al. Opinion by Commissioner Lane:

A 20,000-lb. minimum is excessive as applied to consignments of empty beer kegs in refrigerator cars, but is not excessive with respect to empty kegs and bottles, mixed, or to straight shipments of empty bottles. Reparation awarded as complainant's shipments of empty beer kegs. (19 I. C. C. 590.)

No Discrimination Against Ashland.

City of Ashland v. New York Central & Hudson River. Opinion by Chairman Knapp:

Maintenance of rail-lake-and-rail rates from eastern points to Ashland, Wis., which are higher per 100 lbs. than rail-and-lake rates from same points of origin to Duluth, Minn., is not prohibited by act to regulate commerce. (20 I. C. C. 3.)

Discrimination Against Rome, Miss.

Davenport Commercial Club v. Yazoo & Mississippi Valley. Opinion by the commission:

Rate of 23 cents per 100 lb. on cypress lumber, from Minot, Miss., and Rome, to Davenport, Iowa, found unreasonable and unduly discriminatory in so far as it exceeds rate of 21 cents contemporaneously in effect from same points of origin to Rock Island, Ill., and Moline. (20 I. C. C. 19.)

Semianthracite Coal Rate Unreasonable.

Northern Anthracite Coal Co. v. Delaware, Lackawanna & Western. Opinion by Commissioner Clements:

Defendant's present rates per gross ton for the transportation of semianthracite coal, originating at Bernice, Pa., from Waverly, N. Y., to Binghamton, found unreasonable, and reasonable rates prescribed for the future. (19 I. C. C. 549.)

Correct Method of Weighing.

Wheeler Lumber, Bridge & Supply Company v. Astoria & Columbia River et al. Opinion by the commission:

Where a carload of lumber was weighed twice and showed a variation, the weight obtained in weighing car both trucks at a time preferred to one obtained by weighing them separately. Return of overcharge required. (20 I. C. C. 10.)

Condition Necessary to Granting Reduced Fare Upheld.

National Association of Letter Carriers v. Atchison, Topeka & Santa Fe et al. Opinion by Commissioner Clark:

Defendants tendered in their tariffs special reduced round-trip fares on the certificate plan in connection with convention of complainant, such reduced fares being conditioned on the presentation of 1,000 or more certificates; less than 1,000 certificates were available for visé and therefore reduce fare for return trip was denied. The tariff provisions are binding and must control. Complaint dismissed. (20 I. C. C. 6.)

STATE COMMISSIONS.

John Y. Boyd, a member of the Pennsylvania State Railroad Commission, has resigned, his term of office having expired and he not desiring to be reappointed.

The Railroad Commission of Louisiana has held that the present rates on telegraph messages between points located on different telegraph lines are excessive, and has ordered that the charge between points on different telegraph lines shall not exceed 40 cents for the first 10 words and two cents for each additional word.

The Railroad Commission of Iowa has sent to all of the large express companies operating in the state, an order requiring reductions of from five cents to twenty cents per 100 lbs. in rates on merchandise. The commission declares that the express companies are making excessive profits in that state.

The California State Railroad Commission has issued an order requiring the Southern Pacific and the Atchison, Topeka & Santa Fe to fix rates from Los Angeles to San Joaquin Valley points at the same ratio as is in force between the valley points and San Francisco. The decision was the result of a protest made by the Associated Jobbers of Los Angeles.

The Railroad Commission of Louisiana, after investigating the rates on sand and gravel, finds so many cases of discrimination that a uniform schedule of rates on a mileage basis is ordered on sand and gravel in carloads, minimum weight 80,000 lbs. The rates fixed by the commission are graded from 1½ cents per 100 lbs. for 30 miles and less to eight cents per 100 lbs. for distances over 300 miles.

The Minnesota Railway Commission has directed the railways in that state hereafter, in order to keep the valuations of their properties up-to-date, to report not only the quantity of material used in the improvements and extensions, but also the cost of each item. The original valuations were based on the estimated cost of reproduction, and the commission considers it necessary, in order to keep the valuations up-to-date, to have a record of both the quantities of materials used and the prices paid.

In 1910 the New York Public Service Commission, Second district, had presented to it for action 2,071 cases. These included 1,438 complaints settled without formal orders, 371 formal complaints and 262 applications from various corporations for authorization by the commission. During the year the commission disposed of and closed 1,670 cases. During the three years of the commission's existence 5,496 cases have been presented to it for action. In addition to daily sessions and consideration of disposition of cases, the commission held 554 hearings, covering a period of 196 days. During the year the commission authorized capitalization to the amount of $151,048,108. In 1909 there was authorized $142,855,036; in 1908, $92,253,900; for the last six months of 1907, $17,730,745.49, a total for the three and a half years of the commission's existence, of $403,887,789.

The Wisconsin railway commission asks in its annual report for legislation to increase its authority for the regulation of the issuance of railway securities. The commission's construction of the law was overruled in a case between it and the Minneapolis, St. Paul & Sault Ste. Marie. The commission says that under the interpretation put on it by the state supreme court, the law is now of little value as a means of ascertaining many important facts relating to past issues of securities of public service corporations. It thinks the law should enable it to compel the roads to make their past financing a matter of public record and should prescribe the purpose for which securities may be issued, leaving it to the commission to ascertain whether the purposes of a proposed issue are within the terms of the statute and whether the character and amount of securities proposed to be issued are reasonably required for such purpose.

The Railroad Commission of Louisiana has ordered the Texas & Pacific to cease to lease for or without a consideration a part of its railway property exclusively to one shipper. The commission found that the Texas & Pacific had a contract with J. W. Thompson & Co., by which J. W. Thompson & Co. were to furnish the Texas & Pacific with gravel and in exchange were granted certain privileges in the use of facilities for storing gravel. In addition, the Thompson company paid the Texas & Pacific a rental for bins belonging to the railway and used for storing gravel, and also a rental for certain loading and unloading facilities at a dock. "The commission cannot agree with the position taken by the beneficiary of this extraordinary contract that a common carrier may lease any portion of its properties to him for his exclusive use when there are other shippers desiring to use them for the purpose of shipping the same or similar commodities."

The Louisiana Railroad Commission in a complaint that the passenger train service on the Thibodaux branch of the Texas & Pacific is inadequate finds that the railway company is to blame. The defendant operates a combination passenger and freight train between Donaldsonville and Thiboudaux, scheduled to leave Donaldsonville at 12:20 p. m., and arrive at Thibodaux at 2:00 p. m.; this train seldom leaves Donaldsonville on time, and very rarely arrives at Thibodaux before 4 or 5 o'clock —the distance being 30 miles. The commisison has made a full and complete investigation in this case, having inspected the service. According to the company's records this train did not arrive at Thibodaux, on time, a single day from October 1 to October 21. The country through which the Thibodaux branch runs is thickly settled and the traffic is heavy. There is no reason why the public should be subjected to annoying and unreasonable delays because a railway company desires to combine its passenger and freight business in order to curtail expenses. The company should furnish a separate passenger train to leave Donaldsonville at about 12:20 p. m., daily, and arrive in Thiboudaux not later than 2 p. m., or it should arrange, at once, to carry out its present schedule, if it can be done.

COURT NEWS.

In the United States District Court at Philadelphia, January 4, the Philadelphia & Reading Railway, the Lehigh Valley Railroad and the Bethlehem Steel Co., convicted of violation of the law by cancelling demurrage charges and for failure to observe published tariffs, were fined $40,000 each and ordered to pay the costs of prosecution.

The Supreme Court of the United States has sustained that clause of the interstate commerce law which makes the initial carrier liable for loss of freight even though the loss occur at some point beyond its own line. This clause was the so-called "Carmack amendment" to the Hepburn law, passed in 1906. A persistent fight was made in court against the amendment as a radical departure in legislation. Its constitutionality was attacked by several railways on two grounds: one that it interfered with the liberty of contract and the other that it imposed liability upon the initial carrier for loss on connecting lines when the former had no part in the management of the latter. In effect, the initial carrier was made responsible for other companies' wrongs. The decision was read by Justice Lurton.

The United States Circuit Court of Appeals at New Orleans has decided, in a suit for the enforcement of the safety appliance laws, which arose in Texas, that each defective car is the unit on which the offenses are to be based. That is to say, the car, not the train, is the measure of the offense. In a case where three defective cars were hauled in a single train it is right to collect, not a single penalty, but three penalties. The defendant was the St. Louis Southwestern. In view of the purpose of the act to protect life and limb by the enforced equipment of every car, the Court (Judge Selby) holds that the construction contended for by the defendants would be so narrow as to defeat the intent of Congress.

The New York State Court of Appeals has sustained the state comptroller in his assessment of the franchise tax on new stock issued by the New York Central & Hudson River in January, 1907. The amount of the tax depends on the amount of dividends paid, and the company had claimed that it had not paid the full 6 per cent. dividend on this stock for the entire year. The court upholds the comptroller's assessment on the basis of the whole outstanding stock at the end of the tax year. Chief Judge Cullen writes the opinion. As the company had paid 6 per cent. on the whole of its stock that had been at any time outstanding, the tax therefore should have been assessed on the theory that the whole of the company's stock was a 6 per cent. dividend-paying issue. The company had contended that the assessment should be on the average amount of stock during the year and the average amount of dividends paid.

It is reported in Havana that the President of Cuba has decided to contract with the Cienfuegos, Palmira & Cruces Railway & Power Co. for constructing and operating a line from the Paradero de Caonao to Manicaragua, with a branch from Caonao to Cruces.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Edgar H. Boles has been appointed assistant general solicitor of the Lehigh Valley, with office at New York.

John W. Newlean, auditor of the Chicago Great Western at Chicago, has been appointed general auditor of the Illinois Central and the Yazoo & Mississippi Valley, with office at Chicago.

C. F. Krebs, formerly comptroller of the Illinois Central and the Yazoo & Mississippi Valley, has been appointed auditor of the Chicago Great Western, with office at Chicago, succeeding John W. Newlean, resigned to accept service with another company.

W. B. Biddle, vice-president of the St. Louis & San Francisco, the Chicago & Eastern Illinois and the Evansville & Terre Haute, with offices at St. Louis and Chicago, has been appointed also vice-president of the St. Louis, Brownsville & Mexico. J. H. Elliott, vice-president and general manager of the Beaumont, Sour Lake & Western, and the New Orleans, Texas & Mexico, and vice-president of the Orange & Northwestern at Beaumont, Texas, has been appointed also vice-president of the St. Louis, Brownsville & Mexico, with office at Houston, Texas.

William J. Harahan, assistant to the president of the Erie Railroad at New York, has been elected a vice-president, and will have charge of the engineering department, F. L. Stuart, chief engineer, having resigned. Mr. Harahan was born December 22, 1867, at Nashville, Tenn. He began railway work in 1881 as a messenger and was afterward clerk in the superintendent's office of the Louisville & Nashville, at New Orleans, La. In 1884 he was made an apprentice in the shops of that company, and two years later entered the engineering department of the same road. From 1889 to 1890 he was engineer of maintenance of way of the Cincinnati division of the Chesapeake & Ohio, and then for two years was in charge of structures on the Baltimore & Ohio Southwestern. In 1892 he was appointed roadmaster and later trainmaster of the Pontiac division of the Illinois Central, and from April to October, 1895, was assistant superintendent of the Freeport division, becoming superintendent in October. In August, 1896, he was transferred as superintendent to the Louisville division, and in May, 1901, he was appointed chief engineer, remaining in that position until September of the following year, when he was appointed assistant general manager. In June, 1904, he was made general manager, and in February, 1905, was elected fourth vice-president. He left the service of the Illinois Central in June, 1907, to become assistant to the president of the Erie Railroad. Although Mr. Harahan is to be at the head of the engineering department, he has had unusually broad training in both the operating and the executive departments. In his executive work on the Erie, especially, he has shown himself to be a diplomat in the broad and best sense of the word.

Courtesy, United Press Syndicate.

W. J. Harahan

Operating Officers.

Frank Toucey has been appointed an assistant superintendent of the Union Pacific, with office at Denver, Colo.

W. H. Lochliter has been appointed inspector of transportation of the Baltimore & Ohio, with office at Baltimore, Md.

C. E. Griggs, division engineer of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed a transportation inspector, with office at Newton, Kan.

Richard Doyle, master of transportation of the Grand Trunk at Durand, Mich., has been appointed a trainmaster of the Chicago & Alton, with office at Springfield, Ill.

A. B. Phillips, superintendent of motive power of the Tonopah & Goldfield, at Goldfield, Nev., has been appointed superintendent of transportation and mechanical departments, with office at Goldfield.

R. J. Sullivan, superintendent of the Missouri, Kansas & Texas of Texas, with office at Greenville, Tex., has resigned to accept a similar position with the Wichita Falls & Northwestern, at Wichita Falls, Tex.

The title of James Berlingett, in charge of the transportation and mechanical departments of the Virginian Railway, is assistant general manager. This corrects an item in our issue of December 16, page 1164.

F. P. Gutelius, general superintendent of the Lake Superior division of the Canadian Pacific, at North Bay, Ont., has been appointed general superintendent of the Eastern division, with office at Montreal, Que.; J. G. Taylor, superintendent of the Alberta division, at Medicine Hat, Alb., succeeds Mr. Gutelius, with office at North Bay.

To take care of the operation of the Winston-Salem Southbound, a new district, called the Winston-Salem district, has been formed, comprising the main line of the Atlantic Coast Line, from Florence, S. C., to Wadesboro, N. C., the Hartsville branch and the Winston-Salem Southbound Railway, from Wadesboro to Winston-Salem, and O. T. Waring has been appointed superintendent and W. H. Johnson, assistant superintendent, both with offices at Florence, S. C.

J. E. Craver, superintendent of the Fargo division of the Northern Pacific at Dilworth, Minn., has been appointed superintendent of the Seattle division, with office at Seattle, Wash. A. M. Burt, superintendent of the Dakota division at Jamestown, N. D., succeeds Mr. Craver, and F. L. Birdsall, superintendent at Staples, Minn., succeeds Mr. Burt. A. J. Sovereign resumes his duty as superintendent of the Dakota division, with office at Jamestown, succeeding Mr. Birdsall.

C. C. Walker, general superintendent of transportation of the Chesapeake & Ohio, at Richmond, Va., has been appointed assistant general manager. E. P. Goodwin, general superintendent, at Huntington, W. Va., succeeds Mr. Walker, and J. R. Cray, superintendent, at Hinton, has been appointed general superintendent of the West Virginia general division. J. W. Heron, in addition to his duties as chairman of the car allotment commission, will have general supervision of coal and coke car distribution, reporting to the general superintendents.

Traffic Officers.

B. C. Wurthmann has been appointed a freight solicitor of the Pennsylvania Railroad, with office at New York.

W. K. Lucas. general agent of the Chicago, Indianapolis & Louisville, with office at Lafayette, Ind., has resigned.

J. G. Royster, Jr., has been appointed a soliciting freight agent of the Mobile & Ohio, with office at Kansas City, Mo., succeeding C. C. Harvey, resigned.

F. A. Updegraff, assistant superintendent of the Kansas City Terminal Railway at Kansas City, Mo., has been appointed baggage agent, and his former office is abolished.

J. P. De Vaughn, city ticket agent of the Buffalo, Rochester & Pittsburgh at Pittsburgh, Pa., has been appointed district passenger agent, with office at Buffalo, N. Y., succeeding W. U. Tunison, retired.

W. H. Quigg, general freight agent of the Atlanta, Birmingham & Atlantic at Atlanta, Ga., has been appointed a member of the Working Committee on Uniform Classification, with office in the Merchants Loan & Trust building, Chicago.

W. F. Paton, assistant general passenger agent of the National Railways of Mexico, at Mexico City, Mex., has been appointed general passenger agent, with office at Mexico City. E. T. Winchell, chief clerk in the passenger department, has been appointed assistant general passenger agent, succeeding Mr. Paton.

Joseph B. Cabell, second vice-president and traffic manager of the Philadelphia & Gulf Steamship Company at Philadelphia, Pa., has had his office transferred to New Orleans, La. G. B. Dowdy, assistant traffic manager at Philadelphia, has been appointed traffic manager at that place.

F. J. Shubert, assistant general freight agent of the Rock Island Lines, at Kansas City, Mo., has been appointed general freight agent, with office at Kansas City, succeeding R. G. Brown, who has been appointed an assistant general freight agent, and at his own request transferred to Minneapolis, Minn. Fred Smith, commercial agent at Kansas City, succeeds Mr. Shubert.

R. G. Thompson, district passenger agent of the Wabash Railroad, at Indianapolis, Ind., has been appointed division passenger agent, with office at Fort Wayne, and R. S. Greenwood, Michigan passenger agent, having resigned, the Michigan territory will be assigned to Mr. Thompson. George D. Maxfield, general agent, passenger department, at Buffalo, N. Y., succeeds Mr. Thompson, with office at Indianapolis, Ind., and John Maloney, station passenger agent, at Buffalo, succeeds Mr. Maxfield, with office at Buffalo.

H. G. L. Campbell, division freight agent of the Lake Erie & Western, the Ft. Wayne, Cincinnati & Louisville and the Northern Ohio, at Sandusky, Ohio, has been appointed assistant general freight agent of the Toledo & Ohio Central, with office at Toledo, Ohio, succeeding E. L. Jamison, retired. G. M. Weaver, general westbound agent of the New York Central fast freight lines at Chicago, has been appointed assistant general freight agent of the Michigan Central, with office at Detroit, Mich., succeeding C. B. Griggs, assigned to other duties. George Krause, Jr., division freight agent of the Cleveland, Cincinnati, Chicago & St. Louis at Cleveland, Ohio, has been appointed assistant general freight agent, with office at Cincinnati, succeeding C. H. Jackson, assigned to other duties. G. M. Kridler, division freight agent of the Lake Shore & Michigan Southern at Youngstown, Ohio, has been appointed assistant general freight agent of the Lake Shore, with office at Cleveland. F. A. Curry succeeds Mr. Campbell. L. E. Oliphant has been appointed chief of the tariff bureau of the Lake Erie & Western, the Ft. Wayne, Cincinnati & Louisville and the Northern Ohio, with office at Indianapolis, Ind. The territory of L. L. Hyde, assistant general freight agent at Peoria, Ill., has been extended to cover stations on the main line of the Lake Erie & Western from Peoria to, but not including Tipton, Ind.

Engineering and Rolling Stock Officers.

Charles Kaighn, engineer of the Midland Valley at Muskogee, Okla., has been appointed chief engineer, with office at Muskogee, a new office.

J. E. Schwitzer, assistant chief engineer of the Canadian Pacific, at Winnipeg, Man., has been appointed chief engineer, with office at Montreal, Que.

Charles E. Johnson, division engineer of the Kansas City Southern, at Mena, Ark., has been appointed chief engineer, with office at Kansas City, Mo.

G. E. Bruner has been appointed roadmaster of the new Winston-Salem district of the Atlantic Coast Line and the Winston-Salem Southbound Railway, with office at Florence, S. C. (See an item under Operating Officers.)

C. T. Hessmer, master mechanic of the Minnesota division of the Northern Pacific at Staples, Minn., has been appointed master mechanic of the Seattle division, with office at Seattle, Wash., succeeding W. B. Norton, assigned to other duties. W. C. Radke succeeds Mr. Hessmer.

T. J. Raycroft, master mechanic of the Sterling division of the Chicago, Burlington & Quincy at Sterling, Colo., has been appointed master mechanic of the Alliance division with office at Alliance, Neb., succeeding F. C. Stuby, assigned to other duties. H. M. Barr succeeds Mr. Raycroft.

Francis Lee Stuart, chief engineer of the Erie Railroad, has been appointed chief engineer of the Baltimore & Ohio, and the Baltimore & Ohio Southwestern, with office at Baltimore, Md., succeeding A. W. Thompson, promoted to general manager. Mr. Stuart was born December 3, 1866, at Camden, S. C., and graduated from Emerson Institute, Washington, D. C., June, 1884. He began railway work in 1884 as a rodman under James L. Randolph, chief engineer of the Baltimore & Ohio, and was afterwards consecutively, levelman, transitman and resident engineer until 1887, when he went to Alabama as engineer for the Cahaba Coal Mining Co., locating railways, building coking plants and opening mines. From 1889 to 1891 he was resident engineer in charge of the heavy construction work of the Briafield, Blockton & Birmingham, and later was engineer of maintenance of way on the same road. From 1891 to 1892 he was engaged in various engineering work near Birmingham, Ala., and then returned to the B. & O. as resident engineer in charge of the construction of 20 miles of the line between Uniontown, Pa., and Morgantown, W. Va., and construction work in the Connellsville region. He was later supervisor in charge of the line from Connellsville to Fairmont. From the spring of 1895 to 1897 he was engineer and contractor on various new railways, and was then appointed assistant engineer on the Nicaragua Canal Commission, in charge of the topographical and hydrographic survey of the San Juan river, from Lake Nicaragua to the sea. After the commission returned to the United States he was left in charge and made the hydrographic survey of Lake Nicaragua, returning to the United States in 1898. He was in charge of the estimates of cost of the various canal varients in Nicaragua, and was held over until the Isthmian Canal Commission was formed. As division engineer, he preceded the commission to Nicaragua and prepared the organization. He resigned during the winter of 1899, and again returned to the B. & O., being made assistant engineer on location and construction. His jurisdiction was gradually extended until January, 1903, when he was appointed district engineer, in charge of development of low grade trunk line improvements for the betterment of the B. & O. in Maryland, Pennsylvania and Ohio. In 1904 he was transferred to Baltimore as engineer of surveys of the entire system, resigning this position in March, 1905, to become chief engineer of the Erie Railroad, which position he now leaves to become chief engineer of the B. & O. Mr. Stuart is a resourceful engineer. He is progressive and thorough, and while with the Erie Railroad he carried out to successful completion work on the four-track tunnel and open cut through Bergen Hill at Jersey City, N. J. He also mastered the problem of putting in foundations for a trestle over a swamp on the summit between the Allegheny and Genessee rivers, into which construction piles had been driven 117 ft. without reaching a foundation which would support the trestles. When the wrecking of the swing span of the drawbridge at Cleveland, Ohio, put the crossing out of commission, he took 95-ft. girders into the shop, braced them together, added counterweights, and, mounting the structure on an old turntable center with a pile foundation, made it possible to resume traffic within a short time, the improvised draw swinging through an angle of 90 degrees to permit vessels to go on their way. He is a director of the American Society of Civil Engineers and of the American Railway, Engineering and Maintenance-of-Way Association.

F. L. Stuart.

OBITUARY.

Joseph Albert Jones, first vice-president of the Gulf & Ship Island, died at Gulfport, Miss., on December 25.

Railway Construction.

New Incorporations, Surveys, Etc.

Atlantic & Gulf Terminal.—This line has been opened for business from Ste. Flavie, Que., on the Intercolonial Railway, to Matane, in the Gaspe peninsula. It is proposed to eventually extend the line to a water terminal in the Gaspe peninsula.

California Roads.—A. M. Bianchi and J. E. McFee are making plans to build an electric line from San Luis Obispo, Cal., to Simeon, and from Cayucos to Paso Robles.

Chicago & Wisconsin Valley.—This company is said to have completed plans for building from Madison, Wis., north to Portage, 30 miles, and expects to begin construction work in April. The survey for an extension further north to Stevens Point, an additional 70 miles, will be made soon, and the entire line is expected to be ready for operation before the close of 1912. The line is eventually to be extended north from Stevens Point via Warsaw to Merrill. (August 26, p. 372.)

Colorado Railroad.—See Colorado & Southern.

Colorado & Southern.—An officer writes that grading contract has been given to Kilpatrick Brothers, Denver, Colo., to build the Colorado Railroad from Dixon, Colo., at Sugar Beet loading station, which is 2.5 miles north of Wellington, to Cheyenne, Wyo., 32 miles. Grading is now under way and it is expected that this work will be finished by July. The bridge work will be carried out by the company's men, also the track laying. The work will be moderately heavy earth work and rock work. The line is being built to carry iron ore, coal, lumber, live stock and merchandise. A. D. Parker, president, and H. W. Cowan, chief engineer, Denver. (August 12, p. 294.)

Coney Island & Brooklyn.—This company is planning to make improvements along its line in the borough of Brooklyn, N. Y., at a cost of about $355,000.

Hagerman Valley & Western.—An officer writes that this company will at once equip 10 miles of its line in Idaho with electric power, and is in the market for wire and other supplies to carry out this work. J. M. Morton, president; H. E. Secor, secretary, and H. S. Lower, general manager, Hagerman, Idaho. (September 23, p. 558.)

Kansas City Southern.—An officer writes that during 1910 this company constructed three new division terminals, complete with buildings and tracks, adding about 50 miles of new track. The company now has grade reduction work under way on 20 miles, which it is expected will be finished by March, 1911.

Louisville & Nashville.—According to press reports, this company will rebuild its line from Edgefield Junction, Tenn., which is 10 miles north of Nashville, to Decatur, Ala.

Louisiana & Arkansas.—An officer writes that surveys are now being made from Jena, La., to Vidalia, 48 miles.

Mexican Roads.—A line is being built from San Geronimo, Mex., to Cerro Azul. The E. L. Doheny interests, Los Angeles, Cal., it is understood are back of the project.

National Railways of Mexico.—It is announced that this company will build a branch from Allende, Mex., which is on the International division, 33 miles south of Eagle Pass, Texas, to Las Vacas, Mex., opposite Del Rio, Texas, 90 miles. The plans for the branch were recently completed and placed in the hands of the government for approval. It is expected to have the line finished about the time the branch of the Kansas City, Mexico & Orient will be finished south to Del Rio. A bridge is to be built at this point over the Rio Grande for the joint use of both these companies.

New Mexico Roads.—Preliminary survey is being made for a line from Springer, N. Mex., to Farmington. W. W. Wannamaker, El Paso, Texas, is said to be back of the project.

Panama-David.—See Panama Railroad.

Panama Railroad.—The Panama Assembly has approved a bill authorizing President Arosemena to receive bids for the construction of the Panama-David Railroad. The plans call for a line from the city of Panama, west to David, in the province of Chiriqui, about 300 miles. The cost of this work is not to exceed $10,000,000, for which the government may issue 5 per cent. bonds. The bids will be opened at the end of four months. (April 8, p. 970.)

Pennsylvania Lines West.—To provide additional facilities for handling traffic on the Indianapolis division, the Pennsylvania Lines are making extensive improvements, including the construction of 25.9 miles of second-track. The improvements will eliminate 25 street and highway crossings and two railway grade crossings; this necessitates the construction of four overhead, and 16 undergrade crossings, and the vacation of five highways, formerly crossing the railway at grade. The double-tracking work to be carried out is in two sections, one from Richmond, Ind., to Dublin, 17.6 miles, and the other section from Dunreith to Knightstown, 8.3 miles. The maximum grade will be reduced from 1.1 per cent. to 0.7 per cent., or about 35 ft. to the mile, necessitating a change of grade on 21.3 miles of line. A change of line is also being made on about one mile just east of Knightstown. It will replace a 3 deg. 50 min. reverse curve and a 1 deg. 32 min. curve by a single 1 deg. curve, saving 800 ft. in distance. At other points where the change in grade is considerable an entirely new double-track roadbed is being constructed, and when completed the old route will be abandoned. The double-track road is to be elevated through Cambridge City, Raysville and Knightstown and depressed through Dublin. The company has built 19 concrete arch bridges, 12 steel through floor bridges and three plate girder bridges. The work is about finished on a section of eight miles from Richmond, west, and it is expected that all the improvements will be completed this year.

Phoenix & Eastern.—See Southern Pacific.

Pueblo & Southeastern.—Incorporated in Colorado with $500,000 capital, to build from Pueblo, Colo., southeast to the new town of Wilson, 15 miles. The line will eventually be extended further southeast. William J. Lester, of the Pueblo-Rockyford Irrigation Company, is interested.

Southern Railway.—This company expects to open for passenger and freight traffic soon the low grade double-track line through the city of Lynchburg, Va. This improvement, which has been under way for the last four and a half years, included an entire change of line for several miles from Winesap, which is north of Lynchburg, south to Durmid, and included a 1,300-ft. tunnel under Rivermont, a suburb of Lynchburg; a 120-ft. tunnel under Park avenue; 1,860-ft. steel bridge, 150 ft. high, over the James river; 600-ft. steel viaduct, 115 ft. high, over Harris creek; another 1,000 ft., and 135 ft. high, over Blackwater creek, and one 500 ft. long and 80 ft. high, over Fishing creek; 70-ft. concrete viaduct, carrying Fifth street over the railway yards in West Lynchburg; 150-ft. concrete viaduct, carrying the Lynchburg water supply, and a 150-ft. steel viaduct, carrying a spur track of the Norfolk & Western; also an 80-ft. concrete bridge, carrying Twelfth street. The new line, which runs through the western part of the city, will have lower grades than the existing line. (October 21, p. 760.)

Southern Pacific.—Work has been started, it is said, to change the grade on the Phoenix & Eastern between Kelvin, Ariz., and Winkelman, to avoid floods over the Gila river. The new line is to be 20 ft. higher than the existing one.

Surveys are said to be under way for a line from Yreka, Cal., or Hornbrook, to the Happy Camp mining district.

St. Louis, Bartlesville & Pacific.—The Oklahoma Western Construction Company was organized recently at Bartlesville, Okla., it is said, for the purpose of building this line. The railway company was organized about three years ago to build from Joplin, Mo., west via Vinita, Okla., Bartlesville, Pawhuska, Ponca City, Pine Creek and Tonkawa to Carmen, about 225 miles. Surveys have been made. Residents of Bartlesville raised a bonus of $100,000 and it is understood that financial arrangements have been made in France to carry out the work. Frank Overlees, Bartlesville, is the principal promoter; D. H. Rhodes, chief engineer, 213 Fourth street, Joplin, Mo.

Washington & Choctaw.—Incorporated in Alabama with $200,000 capital, to build from Yellow Pine, in Washington county, Ala., northeasterly to a point 18 miles south of Butler, in Choctaw county. The names of the incorporators are not given.

Railway Financial News.

BOSTON RAILROAD HOLDING COMPANY.—See New York, New Haven & Hartford.

BOSTON & MAINE.—See New York, New Haven & Hartford.

CARTHAGE, WATERTOWN & SACKETTS HARBOR.—The directors have declared the regular 2½ per cent. semi-annual dividend on the $465,000 common stock, and have declared an extra dividend of 5 per cent. Nearly all of the company's stock is owned by the New York Central & Hudson River.

CENTRAL NEW ENGLAND.—The New York Public Service Commission, Second district, has authorized the Central New England to make a mortgage securing $25,000,000, and has given the company permission to issue immediately $12,317,000 bonds secured by this mortgage for refunding purposes. The commission refused permission to the Central New England to refund through the issue of these bonds, the interest on $150,000 7 per cent. Newburgh, Dutchess & Connecticut notes, holding that while the principle of these notes may properly be refunded by the issue of bonds, the unpaid interest, which amounts to $102,000, should be paid from income.

DALLAS, CLEBURNE & SOUTHWESTERN.—See Missouri, Kansas & Texas.

DELAWARE, LACKAWANNA & WESTERN.—President W. H. Truesdale has been elected a member of the board of managers, succeeding J. Rogers Maxwell, deceased.

DELAWARE & HUDSON.—Archibald D. Russell, of New York, has been elected a director, succeeding J. Rogers Maxwell, deceased.

LAKE SHORE & MICHIGAN SOUTHERN.—The New York Stock Exchange has listed $8,927,000 additional 4 per cent. bonds of 1906-1931, and has given the company authority to list $6,073,000 additional bonds on notice of sale and delivery. The $8,927,000 bonds have been sold and arrangements have been made for the sale of the $6,073,000.

MISSOURI, KANSAS & TEXAS.—This company is to ask the Texas legislature to pass a law giving the M. K & T. permission to buy the Dallas, Cleburne & Southwestern, which runs from Cleburne, Texas, to Egan, 10 miles.

NEW YORK, NEW HAVEN & HARTFORD.—It is understood that this company has arranged to sell to J. P. Morgan & Co. about 25 per cent. of the $20,012,000 4 per cent. Boston Railroad Holding Company preferred stock, which is held as a free asset in the New Haven company's treasury. This sale will give the New Haven sufficient cash to pay for about $5,500,000 Boston & Maine new common stock out of the total issue of $10,663,700 recently authorized, and now offered to stockholders at 110, each holder of one share of outstanding common or preferred having the right to subscribe to one share of new common. The Boston Railroad Holding Company preferred stock will be unconditionally guaranteed as to its 4 per cent. dividends by the New York, New Haven & Hartford.

See an item in regard to this company in General News.

OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY.—A valuation of $115,415,000 has been placed on the properties that are to be merged as the Oregon-Washington Railroad & Navigation Company, as follows:

Oregon Navigation	$78,380,000
Oregon & Washington	15,000,000
Columbia River & Oregon Central	950,000
Columbia Southern	1,075,000
Ilwaco	1,000,000
Lake Creek & Coeur d'Alene	790,000
Oregon, Washington & Idaho	3,400,000
Snake River Valley	2,265,000
Umatilla Central	315,000
Idaho Northern	1,400,000
North Coast	7,550,000
Northwestern	2,640,000
Malheur Valley	550,000
Total	$115,415,000

PITTSBURGH, BINGHAMTON & EASTERN.—This property has been ordered sold under foreclosure, and it is said that claims against the company amount to $3,017,525. No date has as yet been fixed for the sale.

Late News.

The items in this column were received after the classified departments were closed.

R. N. Barrows, who has been southern representative for the Atha Steel Castings Company, Newark, N. J., has taken a position as southern railway representative of the Patton Paint Company of Milwaukee, Wis., and Newark, N. J.

The Canadian Pacific on January 15 will take over the St. Maurice Valley Railway and the New Brunswick & Southern The St. Maurice Valley Railway is 84 miles long and runs from Three Rivers, Que., to Shawinigan Falls. The New Brunswick & Southern is seven miles long.

A joint brief for the railways in official classification territory, in the eastern freight rate case, has been filed with the Interstate Commerce Commission. It is signed by Francis L. Gowen, Clyde Brown, O. E. Butterfield, Hugh L. Bond, Jr., George E. Brownnell, Herbert A. Taylor, Edward D. Robbins, Lucien H. Alexander, and J. L. Minnis.

Thirteen lives are believed to have been lost in a rear collision of passenger trains on the Northern Pacific at Cheney, Wash., January 4. Ten or more persons were injured. The North Coast Limited ran into the rear of a Burlington passenger train which was entering a side track, and three cars were wrecked. The Limited when it struck, was running at an estimated speed of 35 miles an hour.

The Chicago, New York & Boston Refrigerator Line has ordered 300 refrigerator cars from the Whipple Car Company. The Boston & Maine, it is said, will place an order at once for 300 passenger cars. It is reported in Pittsburgh that both the Kanawha & Michigan and the Pennsylvania are making inquiries for 3,000 cars each. The Pennsylvania lines west of Pittsburgh are reported to have ordered 20 steel postal cars from the Pressed Steel Car Company.

A suit in equity under the Sherman anti-trust law, alleging an unlawful combination in restraint of trade, has been filed in the United States Circuit Court against thirteen transatlantic steamship companies and twelve of their officers. They are charged with having entered into a conspiracy to monopolize the business of transporting steerage passengers by the formation of the "Atlantic Conference," which allotted to each line a certain percentage of the business, and the members of which are united to suppress all competition by any persons or corporations, other than themselves.

Senator Stephen J. Stilwell, of the Bronx, New York, has introduced a bill in the New York Legislature abolishing the up-state and the New York city public service commissions and establishing in their place two new commissions to be known as corporations commissions. The up-state commission is planned to consist of five members, as at present, at a salary of $10,000 each, the present salary being $15,000 each, and the new commissioners are to be appointed by Gov. Dix. For the present New York city public service commission is substituted a separate corporation commission of five members, one to be elected from each borough, and the salary to be $10,000 each instead of $15,000 as at present. The same powers are given the new commissions as are vested in the Public Service commissions, except in the division of telegraph and telephone supervision.

The Baltimore & Ohio has made a settlement with its machinists, who had been on strike many months. It is understood that the former employees, four or five hundred in number, are to be taken back within thirty to sixty days.

The serious differences as to piece work are said to have been satisfactorily adjusted. The men formerly employed on piece work are to return on that basis, and in shops where piece work has been extended the employees will adopt the piece work basis, having as much time as necessary, but not exceeding thirty days in which to acquaint themselves with the methods.

The fact that some of the men were formerly foremen is not to interfere with their returning to the service as machinists.

All employees reinstated are to be entitled to all their former benefits under the relief feature, including accident and benefit insurance.

Supply Trade Section.

The Spear & Miller Company, Chicago, maker of brake shoes, has removed its office from the Great Northern building to the Railway Exchange.

W. H. Whiteside has resigned from the presidency of the Allis-Chalmers Company, Chicago, and D. W. Call, formerly assistant to the president of the American Steel Foundries Company, Chicago, has been elected to succeed him.

The Block-Pollak Iron Company, Cincinnati, Ohio, announces that Maurice E. Pollak has been elected vice-president and Joseph Michaels, secretary, succeeding Louis Benjamin, who is no longer connected with the company.

The Lackawanna Steel Company will on January 19, 1911, remove its general offices from 2 Rector street, New York, N. Y., to its works at Lackawanna, Erie county, New York. The present New York office will be the address of the assistant to the president, and also a district sales office.

The Harriman Lines have recently closed a standardization contract with the Willard Storage Battery Company, Cleveland, Ohio, for their requirements of train lighting batteries. This contract was awarded to the Willard Company after a thorough service test of all makes of storage batteries extending over a period of two years.

George L. Bourne has resigned as vice-president of the Railway Materials Company, Chicago, and been elected vice-president of the Locomotive Superheater Company, New York, with headquarters at 1115 Peoples Gas building, Chicago. Mr. Bourne was connected with the Railway Materials Company for ten years and previous to that was in railway work.

The United States Light & Heating Company, New York, has built a $500,000 plant at Niagara Falls, N. Y. This plant, though in operation now, will not be completed until next week. The old United States plant in New York, and the Bliss plant in Milwaukee, have been discontinued. The Buffalo plant in Albany, N. Y., is still in operation to meet the large orders.

The McKeen Motor Car Company, Omaha, Neb., shipped a new 55-ft., 200-h. p. steel gasolene motor car to the Charles City Western on December 28. This railway owns an interurban line on which a McKeen gasolene switch engine is being used for construction work. The line is to be operated entirely by gasolene motor cars. A 70-ft. car was shipped to the Arizona Eastern on December 31.

An American legation in a Latin-American country has forwarded copies, with translation, of the specifications for a railway between two local towns, for the construction of which bids are requested. A report, containing a general discussion of the project and the prospects for the successful termination of the same, accompanied the specifications, and can be obtained by interested persons upon application to the Bureau of Manufactures, Washington, D. C.

Tenders are required for the carrying out of surveying operations and the construction of the following sections of railway in Brazil: Sao Pedro to Sao Luiz and S. Barja, Jaguarao to Basilio, and Alegrete to Quarahy. Tenders should be sent before January 12, and should be accompanied by a deposit of 20,000 milreis (about $5,650) and addressed to the Directoriá Geral de Obras e Viacao Ministerio da Viacao e Obras Publicas, Rio de Janeiro. All material which it may be necessary to import for the construction of the above lines will be exempt from customs duties.

TRADE PUBLICATIONS.

Rock Drills.—The Ingersoll-Rand Company, New York, has devoted its bulletin No. 4202 to the illustration, description and advantages of the Sergeant rock drills. It is claimed that the Sergeant drill is today the most powerful, most reliable and most effective independent valve machine on the market, and also the most economical in the matter of repairs and air consumption.

Southern Railway.—This company has issued a list of saw, planing, shingle, stave and heading, sash door and blind, and miscellaneous mills tributary to its line and to the lines of its subsidiaries. This list, prepared by the land and industrial department and dated December 15, 1910, gives the name of the post office at the shipping point, the name of the mill, the kind of timber used and the yearly capacity of each mill for all the mills on its lines. The number of mills is not totaled, and from a superficial examination of the pamphlet the list looks too long to be counted.

RAILWAY STRUCTURES.

ALBANY, N. Y.—According to press reports, the Delaware & Hudson proposes to centralize its heavy repair work in Albany and put up modern shops at that place.

ASHLAND, WIS.—The Chicago & North Western has appropriated $25,000, it is said, to make improvements to its ore dock No. 1, at Ashland.

BEAUMONT, TEXAS.—The St. Louis & San Francisco has secured property on which to build its proposed freight and passenger station. Architects are now drawing plans for the building, which, it is stated, will cost at least $500,000.

DEL RIO, TEXAS.—See National Railways of Mexico under Railway Construction.

LYNCHBURG, VA.—See Southern Railway under Railway Construction.

MONTREAL, QUE.—Application has been made to the Board of Control by the Montreal Central Terminus Co. for leave to construct under its charter a central railway terminal at Montreal. The scheme involves a tunnel under the St. Lawrence river which would be used by the New York Central lines and the Delaware & Hudson, it is said. From the North and the West the terminal would be used by the Canadian Northern and the Grand Trunk. The Canadian Pacific Railway is not interested in the project. The company is capitalized at $30,000,000.

NEVADA, MO.—The Missouri Pacific has let a contract for building a new machine shop and a coal handling plant to cost about $75,000.

NEWARK, OHIO.—The Baltimore & Ohio, according to statements by officers, will build new shops at this point.

OTTAWA, ONT.—The Canadian Northern will build a bridge, it is said, over Metcalfe road, south of Billings street.

PHILADELPHIA, PA.—President McCrea, of the Pennsylvania Railroad, has explained to the board of directors the necessity of improved passenger facilities at Philadelphia, in addition to those being carried out, and upon his recommendation a board of four engineers has been appointed to investigate and report on the many plans and suggestions that have been made.

FOREIGN RAILWAY NOTES.

It is said that the Grand Vizier of Turkey has intimated that the Turkish government favored the enterprise of the Ottoman American Development Company, New York, to build a $1,500,000 railway in Asia Minor. The Americans would begin at Alexandretta and extend the line 180 miles toward the Persian border. The concession has been signed by the Turkish minister of public works and now awaits the approval of parliament.

Lines now projected in Brazil which will probably be in operation within 12 months will bring the total mileage under direct or indirect control of the American operators and French shareholders to a total equal to fully half of the present total railway mileage of Brazil.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Philadelphia & Reading will shortly place an order for the building of 20 passenger locomotives at its shops in Reading, Pa.

The Kentucky & Indiana Bridge & Railroad Company has ordered the two locomotives mentioned in the *Railway Age Gazette* of December 30.

The Nevada Copper Belt has ordered the consolidation locomotive mentioned in the *Railway Age Gazette* of December 30 from the Lima Locomotive & Machine Company.

The Delaware & Hudson, as reported in the *Railway Age Gazette* of December 2, has ordered 11 locomotives from the American Locomotive Company. The order includes 5 ten-wheel locomotives without superheaters, 1 ten-wheel locomotive with superheater, 1 consolidation locomotive and 4 Mallets of the 0-8-8-0 type. The special equipment on these locomotives is the same except where indicated. The specifications for these locomotives are as follows:

Type.	5 Ten-wheel	1 Consolidation locomotive
Simple or compound	Simple	Simple
Weight on drivers	140,000 lbs.	178,000 lbs.
Total weight	Engine, 186,000 lbs.	Engine, 202,000 lbs.
Diameter of cylinders	21 in. diameter	23 in. diameter
Stroke of pistons	26 in. stroke	30 in. stroke
Diameter of drivers	63 in.	57 in. diameter
Type of boiler	Extended wagon top	Straight top
Working steam pressure	200 lbs.	175 lbs.
Heating surface, tubes	2,639	2,103
Heating surface, firebox	150	170
Heating surface, total	2,789	2,273
Tubes, number	350	{ 198 { 30
Tubes, outside diameters	2 in.	{ 2 in. diameter { 5⅜ in. diameter
Tubes, length	14 ft. 6 in.	14 ft. 6 in.
Firebox, type	Narrow radial stay	Narrow radial stay
Firebox, length	96 in.	102 in.
Firebox, width	75¼ in.	75¼ in.
Firebox, material and maker	Carbon steel	Carbon steel
Grate area	50.2	53.3
Tank capacity for water	6,800 gals.	7,800 gals.
Oil capacity	3,000 gals.	3,000 gals.

Type.	Mallet	Passenger and freight locomotive, 4-6-0 type
Simple or compound	Compound	Simple
Weight on drivers	450,000 lbs.	142,000 lbs.
Total weight	450,000 lbs.	Engine, 190,000 lbs.
Diameter of cylinders	{ H. P., 26 in.; { L. P., 41 in.	23 in. diameter
Stroke of pistons	28 in.	26 in. stroke
Diameter of drivers	51 in.	63 in.
Type of boiler	Conical type	Extended wagon top
Working steam pressure	220	170 lbs.
Heating surface, tubes	5,245	1,982
Heating surface, firebox	353	150
Heating surface, total	5,598	2,132
Tubes, number	{ 270 { 42	{ 193 { 26
Tubes, outside diameter	{ 2¼ in. diameter { 5½ in. diameter	{ 5⅜ in. { 2 in.
Tubes, length	24 ft. 0 in.	14 ft. 6 in.
Firebox, type	Wide radial stay	Narrow radial stay
Firebox, length	126 in.	96 in.
Firebox, width	114 in.	75¼ in.
Firebox, material and maker	Carbon acid	Carbon steel
Grate area	99.85 sq. ft.	50.2
Tank capacity for water	9,000 gals.	6,800 gals.
Coal capacity	14 tons	.....
Oil capacity	.....	3,000 gals.

SPECIAL EQUIPMENT.

Axles, engine	(H. L.) Carbon steel, Cunningham treated
Axles, tender	Cambria steel, Coffin treated.
Bellringer	Trojan.
Boiler lagging	Keasby & Matteson sectional magnesia.
Brakes	Westinghouse-American Combined E T 6.
Brake beams	No. 1 Waycott special.
Brake shoes	Diamond S with Christie head.
Brick arch	For oil burning on all except Mallet type.
Couplers	R. E. Janney.
Driving boxes	Cast steel; cypress metal bearings on all except Mallet.
Driving boxes	Cypress bronze bearings on Mallets.
Headlight	Dressel 18 in.
Injector	Hancock.
Journal bearings	Brady Brass.
Piston and valve rod packings	Trojan.
Safety valve	Consolidated.
Sanding devices	Hanlon pneumatic and hand.
Sight feed lubricators	Ohio.
Staying	Radial and Tate Flexible; Taylor Iron.
Steam gages	Ashcroft.
Steam heat equipment	Consolidated on all except consolidation locomotive.
Superheater	Schmidt on all except 5 ten-wheel engines.
Tires	Midvale O. H. steel.
Tubes	Worth Bros.' charcoal iron on all except Mallet.
Tubes	Parksburgh charcoal iron on Mallet.
Valve gear	Walschaerts on all except 5 ten-wheel type.
Valve gear	Baker Pilliod on 5 ten-wheel type.
Wheel centers	Cast steel.
Other specialties	Franklin pneumatic fire door on all; Chicago flange oiler on all; Elvin lubricators on all; Franklin water joints on the Mallet.

The Imperial Government Railways of Japan has ordered 24 Pacific engines and 6 Mallets of 0-4-4-0-C type locomotives from the American Locomotive Company. The cylinders of the Pacific will be 18½ in. x 24 in., the driving wheels will be 63 in. in diameter and the total weight in working order will be 133,000 lbs. The cylinders of the Mallets will be 15½ in. and 24½ in. x 24 in., the diameter of the driving wheels will be 63 in., and the total weight in working order will be 122,000 lbs.

CAR BUILDING.

The Hagerman Valley & Western, Hagerman, Idaho, is in the market for 2 electric motor cars.

The New York, Ontario & Western, as reported in the *Railway Age Gazette* of December 30, has ordered 450 coal cars from the American Car & Foundry Co., to be built at Berwick, Pa. Of these cars 350 will be hopper bottom gondolas, and 100 will be drop bottom gondolas. The hopper cars will have 80,000 lbs. capacity and will weigh 38,500 lbs. The inside measurements will be 33 ft. in length, 8 ft. 11½ in. in width, and 5 ft. ½ in. in height. The over-all measurements will be 34 ft. 6 in. in length, 10 ft. 2¾ in. in width and 9 ft. 4½ in. in height. The bodies will be of wood and the underframes of steel. The drop bottom cars will have 80,000 lbs. capacity and will weigh 36,000 lbs. The inside measurements will be 38 ft. in length, 8 ft. 7 in. in width and 30 ft. in height. The over-all measurements will be 39 ft. 10 in. in length, 9 ft. 9 in. in width and 6 ft. 10 in. in height. The bodies will be of wood and the underframes of steel. The special equipment for both types is the same, as follows:

SPECIAL EQUIPMENT.

Bolsters, truck	Gould cast steel.
Brakes	Westinghouse.
Brake beams	Buffalo No. 2,
Brake shoes	Steel back G. 724.
Brasses	Brady Brass Co.
Carry iron	Flory.
Couplers	Sharon.
Draft gear	Farlow.
Dust guards	D. P.
Journal boxes	Symington.
Roller device	Barber.
Trucks	Gould cast steel.
Wheels	33-in. cast iron.

IRON AND STEEL.

The Pennsylvania Lines West are in the market for 300 tons of bridge steel.

The New York, New Haven & Hartford is in the market for 150 tons of bridge steel.

General Conditions in Steel.—The majority of steel men believe that the present prices will be rigidly maintained until the spring at least. It is thought that even a reduction in prices would not induce the railways to enter the market for any larger orders than were absolutely necessary, at least until after the decision of the Interstate Commerce Commission in regard to the freight rate increase. Last week the prices of structural steel and spikes were reduced until the producers realize only a small profit. The inventories of the middleman are exceptionally meager, so it is hoped that there will be a sharp increase in orders in the near future. The orders of all steel companies at present amount to about 40 per cent. of their capacity.

SIGNALING.

The Chesapeake & Ohio, in a statement of block signal mileage, which was received too late to be included in our table last week, shows that it has increased its automatic mileage during the past year from 48 miles to 183 miles; and on its line through Indiana, formerly the Chicago, Cincinnati & Louisville, the manual block system, operated by means of telephones, is in use the whole length of the road. This makes the totals for the Chesapeake & Ohio system as follows: Automatic, single track, 0; double track 183 miles; manual, single track, 1.543 miles; double track, 126 miles; total both kinds, 1,852 miles. The non-

automatic includes 242 miles controlled manual, two-thirds of this being single track. In the new automatic block signaling, the block sections average 2½ miles in length, and the distant signals are on separate posts.

The Evolution of Corrugated Metal Culverts.

BY PERRY VAN HORNE.

It is probably not generally known, but it is a fact nevertheless, that corrugated metal culverts have been in use in certain localities in the United States for over a quarter of a century.

Originally they were made with cheapness paramount, hence of very light gage galvanized steel, with no pretensions other than that of temporary, or at the best uncertain, longevity. Many of these culverts have long since disintegrated, the result of varying deteriorating elements of the earth in which they were imbedded; others, it is claimed, are still in a fair state of preservation.

Ten years or more ago a commendable tendency was evidenced on the part of various corrugated culvert manufacturers to consider the future. They commenced to operate in the belief that corrugated metal culverts, if made of the right thickness and of a quality of metal superior to galvanized steel, could reasonably be expected to give practical and lasting service. With this in view, the use of extreme light gage metal, which had theretofore prevailed, was discouraged, and increased gages such as Nos. 18 and 16 for smaller sizes and No. 14 for the largest were adopted as a fair standard.

Still later experiments were commenced and have continually progressed toward developing a metal on a commercial basis which should surpass steel and equal or excel, from the standpoint of anti-corrosive characteristics, the well-known old-time iron products. That metal meeting these requirements has been perfected is now a matter of common knowledge to the trade.

In recent years calculations based on the adoption of heavy gages and material of this superior quality, properly galvanized, have been substantially confirmed, with the natural result that corrugated culverts have continued to grow in demand, to undergo improvement and to give satisfaction. Today they are not only recommended by metallurgical chemists and specified by engineers generally, but are also in satisfactory use by the United States government, various foreign governments and under the heaviest traffic-bearing railways, city streets and country highways everywhere. And they are supplanting in a large degree all other kinds of culverts.

Up to about four years ago the common style of corrugated culverts was cylindrical and riveted. About that time a new and novel idea was evolved in a corrugated culvert made of upper and lower sections with lateral flanges, to be shipped knock-down and nested and set up by the use of bolts. This culvert was also characterized by the embodiment in its manufacture of still heavier gages of metal than had ever before been used—including for the smaller diameters Nos. 16, 15 and 14, and for the larger sizes Nos. 12 and 10 gage metal of special anti-corrosive properties, overcoming to a great extent the common criticisms regarding lightness and the effects of corrosion so common to ordinary steel. These better grades of heavier gage culverts—both the round-riveted and the nestable, by reason of their comparative lightness and strength and their ease in handling, hauling and installing—have accomplished much toward revolutionizing permanent road improvement.

The *Engineering News*, a well-known technical journal, commenting editorially on corrugated metal culverts, in its issue of January 20, 1910, had the following to say:

"To an engineer of the old school, accustomed to build always with an eye to permanence and solidity, the idea of putting a culvert of thin corrugated iron under an earth embankment may seem like a crude makeshift, which ought to be condemned offhand without discussion. Very likely the first use of corrugated iron for culverts was a makeshift; but experience appears to show that under certain conditions culverts of this apparently flimsy construction have made good.

"Such culverts are exceedingly cheap, are very light to transport and place, and have so much elasticity and 'come and go' that they will stay in place when unequal settlement occurs where a much heavier culvert would be cracked and broken. For temporary work such culverts are especially advantageous, as they are cheap to place and can be re-covered if the bank is removed.

"The rapid rusting out of sheet iron or steel exposed to the alternate wetting and drying that a culvert receives naturally occurs as a foremost objection to corrugated iron culverts, but some of these metal culverts are said to have been in service for some fifteen years. By using a special grade of metal of high purity the resistance to corrosion is expected to be so greatly increased that the culverts may fairly be classed as permanent construction."

A state highway engineer of a western state (Missouri), in a bulletin some time since issued on the subject of Bridges and Culverts, had the following to say regarding corrugated metal culverts:

"Large quantities of corrugated metal for pipe-culverts and similar products are put on the markets, some of which give good satisfaction, while others do not. Some of the pipe used for culverts in this state has stood but two years, while others have been in use six times that period and are still good. * * * A good weight and quality of corrugated pipe will last fifteen or twenty years. The difficulty is to know when you are getting a good quality, and for this reason we advise great care in buying corrugated culvert pipe. Do not buy unless you feel sure of the quality—there are all kinds on the market."

The state highway commissioner of an eastern state (Pennsylvania), in a bulletin lately published on the subject of Supervisors and Their Duties, says:

* * * "From this fact comes the corrugated metal pipe which has been on the market for several years past. If made of ordinary steel, the use of such pipe cannot be condemned too strongly, but if made of special material containing so small a percentage of impurities as to be practically pure iron, it will be found an economical investment for a township."

The sentiments expressed in the foregoing quotations have been corroborated in numerous papers and reports from time to time by the most eminent engineers and metallurgical chemists in this country. Dr. Allerton S. Cushman, formerly assistant director and chemist, U. S. Department of Agriculture, Office of Public Roads, in a bulletin recently published said among other things:

* * * "It seems to be a fact that carefully made metal in which the ordinary impurities are cut down to mere traces and in which the heat treatment has been carefully controlled, is much more resistant to corrosion than ordinary types of metal with a comparatively high percentage of impurities. * * * The demand for this type of metal appears to be growing, and it has been largely used for the manufacture of road culverts. * * * The fact that this new metal has been largely specified by culvert manufacturers, even at a somewhat added cost, is the best evidence that it is meeting a long-felt want in this and allied industries."

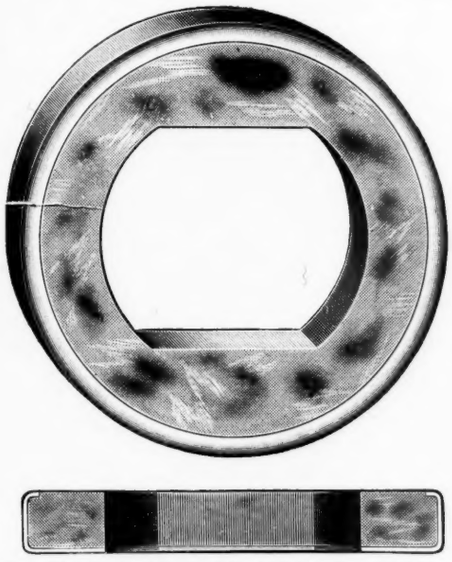
Thus it appears that corrugated culverts made of such recognized rust-resisting galvanized material as No-Co-Ro Metal, American Ingot Iron and Toncan Metal, instead of ordinary steel, and of the proper gages, properly galvanized—giving the service that they have for years past—are recognized and accepted as a very formidable and worthy suitor for practical and general adaptability in the culvert field at large.

It is a safe assertion that were it possible to compile a general consensus of conscientious opinions of reliable authorities as well as laymen who have investigated the merits of these improved metals as compared with ordinary steel, the great majority would express themselves as unequivocally in favor of the complete elimination of steel in the manufacture of corrugated culverts.

If any one feature is likely to militate more seriously than another against the prospective future success and permanence of corrugated culverts—whether of steel or the purer metals—it is the continued detrimental exploitation of thin gage, flimsy material. If people will persist in buying too light weight and otherwise inferior corrugated culverts for no other reason than that they are cheap, only to reap dissatisfaction, as they certainly must in a comparatively short time, they should at least be fair enough to withhold judgment until they have given the better culverts a trial and not prematurely and indiscriminately condemn the various other worthy corrugated culverts, made of purer metal and heavier gages, any of which may be bought at a reasonable price, with general satisfaction assured.

Goetze Gaskets and Valve Disks.

The leaks in flange joints and unions on steam boilers, steam engines, steam pipes, apparatus, etc., are partly due to a faulty construction of the joints or couplings; insufficient strength of the flanges and covers; imperfect, rough, uneven and deeply corroded surfaces; to the surfaces being out of parallel; and an insufficient number of coupling screws, or placing them at uneven distances. Leaks are also caused by rigid piping, i. e., piping which cannot sufficiently expand and contract, as well as in piping and other appliances subjected to excessive pressure from water hammer, resulting from an insufficient slope to allow the condensed water to



Goetze Valve-Gasket With Two Sides Flat Inside.

run off. The chief cause of leaks, however, is to be found in the use of packing material incapable of continuously withstanding the influence of high temperature of steam and water or high pressure gases and acids.

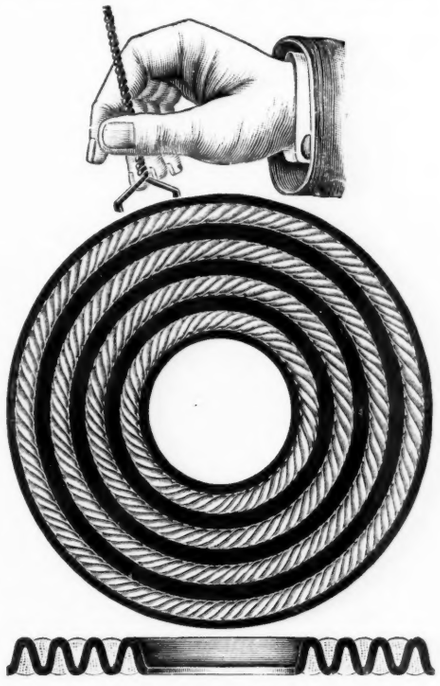
The Goetze copper and metal gaskets here illustrated provide a packing material which will comply with all requirements. They are so arranged as to present a surface that conforms to every irregularity in the flanges, while effectively resisting high pressure and temperature. The Goetze elastic corrugated copper gaskets with asbestos lining No. 2 are made of chemically pure copper and the best asbestos. Only a few turns on the flange bolts brings each copper corrugation snugly against the flange surface and at the same time crowds each wall of asbestos against the same surface. Through the use of elastic copper and metal gaskets on flange joints it has become possible to use long-distance conduits for steam under a pressure exceeding 15 atmospheres, the joints being kept tight for a number of years.

The Goetze copper valve disk with asbestos inlaid has all the elasticity needed for tight closing and is adapted for great durability under the most unfavorable conditions. All sizes suitable for Jenkins valves and other valves of similar construction are kept in stock.

GOETZERIT SHEET PACKINGS.

In spite of the advantages of Goetze copper and metal gaskets, there are those who wish to cut their own packings from the sheet, or who for some reason do not want a metal or shaped gasket. For such, Goetzerit, a sheet packing, has been perfected. It is made in both red and white, from asbestos fiber, compressed under an exceedingly high pressure and impregnated with a substance which, it is claimed, makes it absolutely proof against the action of superheated and saturated steam. Goetzerit white packing is especially recommended for oils, benzine, petroleum acids, ammonia, gas, alkaline products, etc. It does not squeeze out and decrease the inside diameter of the piping, and cannot be blown out, even at the high steam pressures now in use.

Goetzerit red packing is made in any desired thickness in sheets 36 in. square. The white is made in sheets 45 in. square. Ready-made Goetzerit gaskets for standard and extra heavy flanged fittings of from 1 to 24 in. are also made. Another kind of packing is known as Self-Lubricating high-pressure packing. It is equally suited for saturated and superheated steam and for hot and cold water and is impregnated by an infusible fat which is proof against heat and is said to

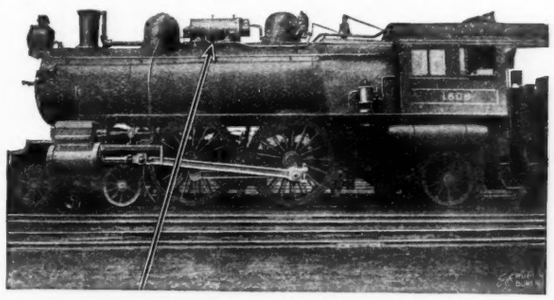


Goetze No. 2 Gasket.

have practically inexhaustible lubricating ability. It is prepared for all kinds of stuffing boxes and is manufactured in sizes from ¼ to 2 in. square. These packings are manufactured by the American Goetze Gasket & Packing Company, New Brunswick, N. J.

Curtis Turbines for Train Lighting.

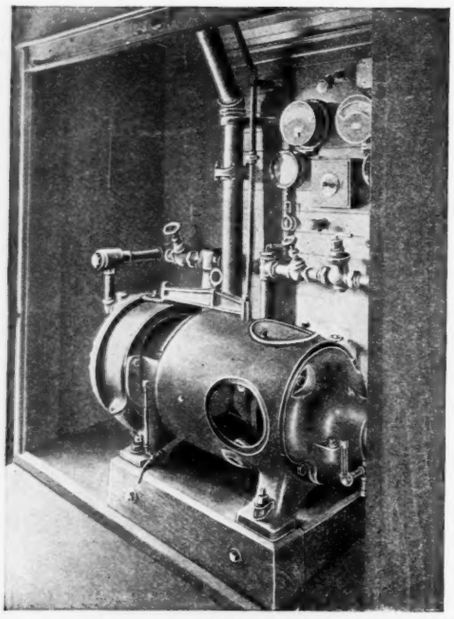
Curtis turbo-generators installed on a locomotive or in a baggage car, as shown in the illustrations, meet the most exacting demands of train lighting service. These sets consist of a Curtis turbine direct connected to an electric generator. They form compact, sturdy units so simple in construction that they require practically no attention. At the present time, when railways are making every effort to insure the greatest degree of safety to



Curtis Turbo-Generator as Applied to a Locomotive.

passengers, these sets are meeting with great favor, as their use eliminates all danger from fire or explosion due to the leakage of illuminating gas in case of an accident. The superior quality of the light due to the excellent voltage regulation of the Curtis turbine is a feature which will be appreciated by the passengers. Each car is brilliantly illuminated with a steady light. This service permits the use of electric cooking and heating utensils in buffet and dining cars, and of electric toilet articles in drawing and sleeping cars. For suburban service no aux-

iliary equipment is required, and the Curtis turbine affords a simple and economical equipment, dispensing with batteries, boosters and regulators. Over 300 Curtis turbines are now in use on steam railways, and many railways have adopted this system as a standard equipment for train lighting. There are 67 of these turbines now in service on the Chicago, Burlington & Quincy, 42 on the Great Northern, 42 on the Northern Pacific, 43 on the Chicago, Milwaukee & St. Paul, and a smaller number on a large number of other roads. These turbines are supplied by the General Electric Company, Schenectady, N. Y.



Curtis Turbo-Generator Installed in a Baggage Car.

Tractor for 100-ft. Turntable.

The increasing use of Mallet locomotives of great weight and length has brought the railways face to face with the difficult problem of turning these locomotives. In the first place, they are very heavy, the weight running to 350 tons and over, but what makes the problem of turning even more difficult is the great length of wheel base. Furthermore, if a table but slightly longer than the locomotive is used it will be very much more heavily loaded at the end under the locomotive than under the tender, even when the tender is fully loaded with coal and water. To make it possible to balance such locomotives under all conditions would require the construction of turntables of excessive length, the direct and indirect expense of which would be enormous.

The other alternative is to turn the engine on tables merely long enough to carry them without making any attempt at balancing. When one realizes that this means carrying an unbalanced load of upwards of 50 tons in some cases on the trucks at one end of the table it will readily be seen that a powerful tractor must be used. Geo. P. Nichols & Bros., Chicago, have recently developed an electric tractor for this class of service which in general arrangement and appearance is similar to their standard electric tractor, but with a tractive effort increased to meet the severest requirements. The illustration shows one of these tractors handling the Virginian engine No. 600 on a 100 ft. turntable. This locomotive weighs 315 tons and is 96 ft. 4 in. long. The tractor is one of four of the same power in service on the Virginian. Similar equipment is in successful service on other railways, performing equally heavy duty.

The Clark Blow-Off System.

Notwithstanding the many improvements made in the performace and maintenance of locomotive boilers by the use of purified water and by putting soda ash in the tank, it is a matter of common observation that when locomotives come in for repairs many of them have the tubes and fireboxes badly scaled and have a large amount of mud and lime sediment in the barrel of the boiler and in the water leg. Although conditions have vastly improved, it is still necessary on many railways to wash out boilers frequently—usually once a week. When in service they do not render maximum performance on account of the scale accumulation preventing the more direct transmission of heat through the sheets, or because of priming the water is carried to the cylinders, making it necessary to run with partly opened throttle, giving less initial pressure. Also a larger consumption of expensive cylinder oil results when boilers are priming.

These are still the ordinary experiences in locomotive opera-

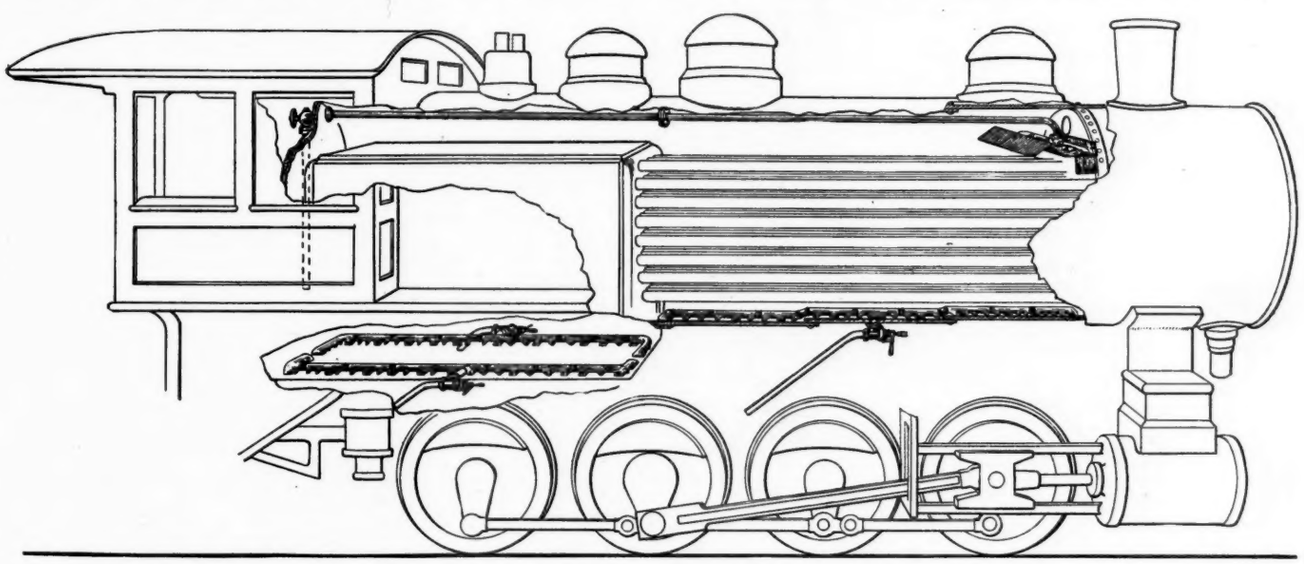
100-ft Turntable with a Nichols Electric Tractor.

tion on many railways and they are the cause of extra expense which could be saved by the use of recently improved devices for systematically blowing off the boiler in service. The heavy expense is due, first, to the labor involved in the frequent washing of boilers, to the attendant damage to the tubes and sheets by stresses due to unequal expansion; there is the further loss of mileage while the engine is so frequently in the roundhouse for washing out. The effort to prevent foaming and the accumulating of sludge and scale by the ordinary blow-off valves is not effectual, because their action is local and not general. A blow-off valve at the front of the firebox removes the mud and some scale which has dropped down from the immediate vicinity of the valve opening, but it is proved that it does not remove it from the side water legs by the amount found accumulated in this portion when the engine is in for boiler washing. Blow-off valves are also used in the front course of the boiler shell, but they, too, only remove the mud from that immediate vicinity and a large accumulation is found farther back, which requires that the boiler be washed out the same as if the blow-off valves had not been used.

It is necessary to have the current of water move at high velocity in all parts of the boiler where mud accumulates, so it will carry the sediment along with it; to secure this the area of the passages must be restricted. With a valve opening directly into the water space there is a flow from all directions toward this opening, and the volume is so large that it fills the outlet without attaining a high velocity, and the object of a general cleaning is defeated. The Clark blow-off system successfully corrects this fault by placing brass ducts around the mud-ring, and along the bottom of the boiler for the length of the shell. The openings are funnel shaped and the distance between them gradually decreases as the distance from the blow-off valve increases. In service the blow-off valve is opened and closed rapidly, causing a rapid flow of water into each orifice which carries with it a large amount of sediment. This operation should be performed at least three times a day and always after the engine has been standing long enough for the suspended matter to settle.

The lighter suspended matter floating on the surface of the water becomes mixed with the bubbles as steam is formed, and with alkali waters gives constant trouble from foaming. Skimmer blow-off valves have been used with beneficial results for many years, but with a single opening into the water level their action, like that of the ordinary blow-off valve, is entirely too local, and only removes the foam and lighter suspended matter from the surface immediately surrounding the opening. In the Clark system the skimmer bar extends the full width of the boiler and is placed at the top of the tubes near the front tube sheet. Long experience has shown that a skimmer in this location with an apron and openings extending across the bar clears most of the water surface, removing the foam and alkali material which is not precipitated. Where purification plants are in use there is often a surplus of alkali which causes foaming; here the skimmer is especially useful. The skimmer valve in the Clark system of blow-off is located on the boiler head, and should be opened a few seconds at least twice a day when the engine is using steam. It should also be opened a few seconds at any time the boiler is foaming.

The Clark blow-off system was invented by an engineer in Illinois, but heretofore has been like a prophet without honor in his own country. It has been developed in England and used in the far-off countries of India, Australia, South Africa and South America. More recently it has been introduced on a dozen railways in the western part of the United States with such success that many orders are now being received for it. The practical results derived from this system are that the boilers can go ten times as long without washing out, thus saving loss of mileage, and that the fuel economy is greater, due to the absence of scale and mud on the heating surface. It also prevents the water being carried over with the steam to the cylinders. There are also incidental economies connected with boiler repairs when this device is used. A report from one of the lines which is using the Clark blow-off system says: "There is a remarkable reduction in the cost of light boiler repairs, such as broken staybolts, rolling of tubes, etc. When boilers are washed frequently the repairs due to irregular expansion and contraction are considerable. Boilers are seldom washed without having to renew staybolts and tighten tubes. An engine on this line which is equipped with the Clark blow-off has now run two periods of 41 days each without a broken staybolt."



The Clark Blow-Off System.

Information regarding this device may be obtained from the exclusive agents, the Horace L. Winslow Company, Old Colony building, Chicago.

Cyclone Chain Hoist.

The 40-ton Cyclone chain hoist made by the Chisholm & Moore Manufacturing Company, of Cleveland, Ohio, was described on page 1100 of the December 2 issue of the *Railway Age Gazette*, but unfortunately an error was made in giving the address of the company as Chicago. If any of our readers have written to the wrong address for additional information concerning these hoists they will understand why their letters have not been answered, and will confer a favor by writing to the proper address.

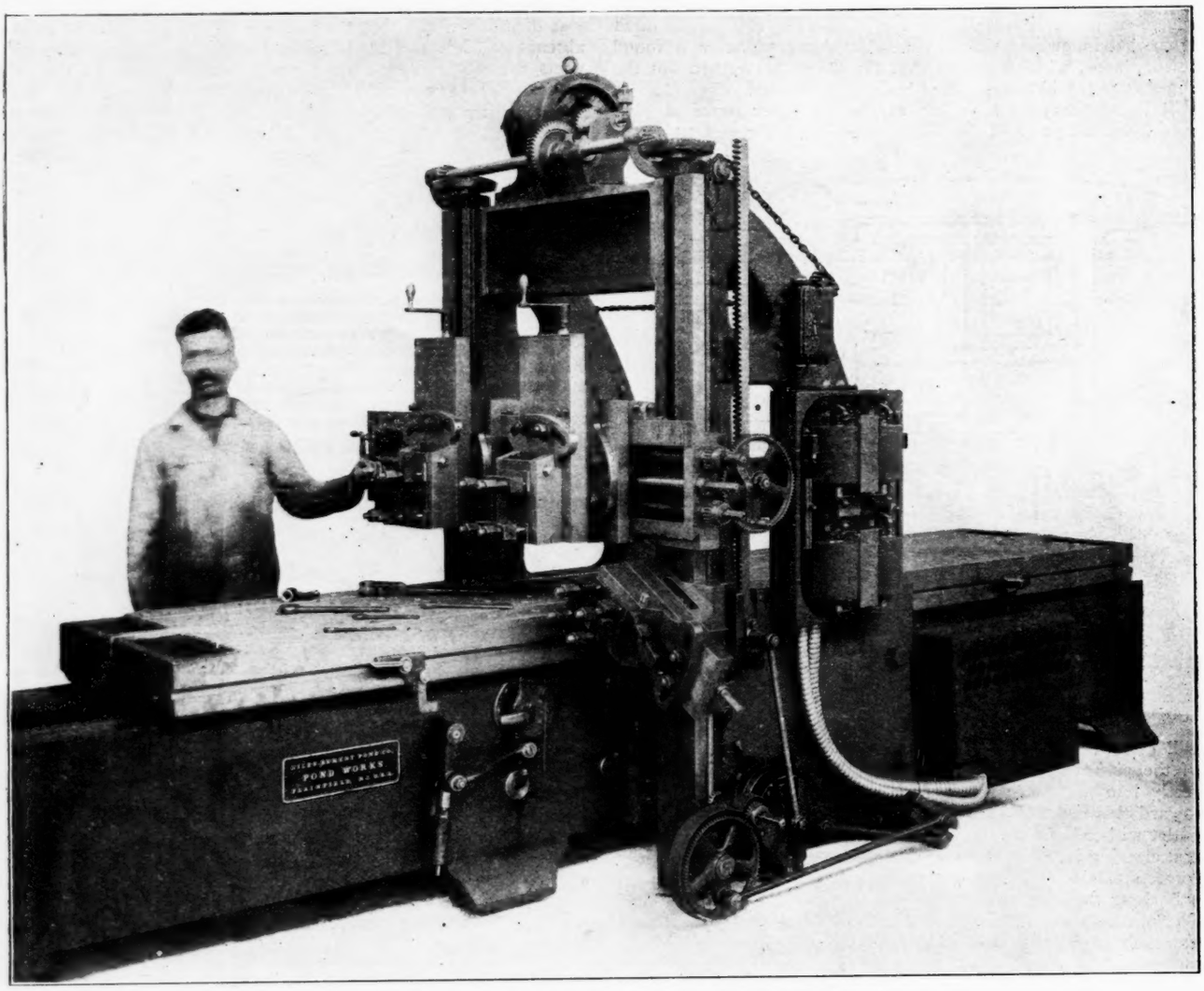
Events are shaping toward the realization of a Transcaspian Railway connecting Russia and India. An international company will be formed in which Russia, Great Britain and Persia will be predominant, but in which French, German and other interests will be welcomed. It is proposed to build 1,600 miles of line at an estimated cost of about $105,000,000. It is figured that passengers and mails could be carried by the proposed road from London to Bombay in seven or eight days.

Shop Equipment.

Pond Reversing Motor Planer.

The Pond works of the Niles-Bement-Pond Company, New York, has put on the market a reversing motor planer which is specially adapted to locomotive work. It offers an entirely new method of driving and reversing at variable speeds and is the outcome of years of experimenting. It has proven itself absolutely reliable under the most severe and adverse conditions and overcomes all the undesirable features of the belt and gear-box drives, doing away with all clutches, either pneumatic or magnetic, and all shifting belts. As shown in the illustration, a motor with speeds varying from 250 to 1,000 r. p. m. is direct connected on the left side of the machine, out of the way of the operator, with the controlling box on the right. The pilot switch, located on the bed of the machine, is operated by dogs fastened to the table. This pilot switch operates the controlling mechanism which reverses the machine by reversing the direction of rotation of the motor. The controlling mechanism is made up of four solenoids which operate sheet copper contact connections to the motor. On the controller are mounted two index scales, one controlling the cutting speeds and the other the return speeds. Each scale is provided with 13 graduations, by means of which the same number of different motor speeds may be obtained. The cutting and return speed regulation is entirely separate, so that the slowest cutting speed may be used with the maximum return speed. The cutting speeds obtainable on the standard type of planers vary from 25 to 40 feet and the return speeds from 60 to 100 feet, but these, of course, can be changed to suit individual requirements. It will be seen from the illustration that the pilot switch may be controlled by hand, which enables the operator to have greater control over his work. For example, in working castings with hard spots or thin walls, by operating the pilot switch, the speed of the table may be decreased at will. The action of the controller is such that it is possible to stop the table within a limit of ⅛ in. by throwing the pilot switch to the neutral position. Reversing is accomplished so positively that a stroke of 4½ in. can be taken on a 96-in. machine while operating at a comparatively high speed.

The kinetic energy stored in the work, planer table, armature and other moving parts of the machine is absorbed by the braking action of the opposing torque of the fields on the rotation of the armature, and is accomplished without the least shock, jar or hesitation. The current generated by this action passes into the starting resistance, and then off as heat, the result accomplished being exactly the same as if some form of mechanical brake had been applied to the motor to bring the planer to a stop, with the difference, however, that the action is perfectly smooth, there are no wearing or frictional surfaces to contend with, and it needs no adjustment. The overload on the motor at the instant of reversal is never over 50 per cent. The entire drive of the planer is on the floor, or near the floor, where it is readily accessible. Owing to the absence of the usual belts, clutches, etc., the variable speed planer occupies a minimum floor space. The Pond reversing motor planer is in use at the West Albany shops of the New York Central, and the Juanita shops of the Pennsylvania.



Pond Planer With Electric Reversing Mechanism.